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Waste or Economy in Milwaukee

The Railroad Commission of Wisconsin has found that the city of Milwaukee can save money by making a contract for street lighting with the public utility company instead of building a municipal plant. The annual saving will approximate $46,873, a sum equal to over 4½ per cent interest on $1,000,000. The actual investment required by the city in the event of the construction of a municipal plant is figured by the commission at $1,493,758. However, the investment of this sum is only part of the hazard that would be incurred by the city. The practical-minded Wisconsin commission has calculated the various elements of operating expense and set them forth so fully that the issue is as clear as the light itself. It becomes a question of whether the best interests of the city would be served by supine compliance with a Socialist program at a waste of money or by a businesslike contract with the existing utility at a saving. It is not necessary to consider whether, if the city can get a reasonable rate, it is morally bound to patronize the company which supplies its citizens, nor is it necessary to consider the economic waste ignored when a competing plant is created to provide service that an existing property can furnish. When a merchant receives two bids for like service or commodities, good judgment leads him to accept the lower one. The conclusion of the commission in this case should end the talk of municipal service for Milwaukee.

Resuscitation Hero Medals

As a practical aid to electrical-resuscitation propaganda, there is merit in the hero-medal plan suggested by Dr. Lauffer before the Eastern New York Section of the N. E. L. A. and indorsed by that convention for adoption by the national association. The physician urged that bronze medals be awarded to persons who save lives by resuscitating victims of electric shock, and proposed further the institution of a commission to investigate the merits of each case and the conditions leading to the accident. The sentimental value of such a medal need not be emphasized in this discussion, nor will it be contended that the promised reward of a bit of bronze could in the slightest influence any humane person in efforts to bring an unfortunate fellow-creature back to life and consciousness. Needless to say, the problem is not that of stimulating the potential rescuer after the accident has happened; but it does lie in getting him to equip himself in advance with the necessary first-aid information so that he will have it available at the critical moment. Right here is the value of the medal scheme in forearming the rank and file of the industry with knowledge of resuscitation methods. When such information is needed it must be available instantly. There must be no delay in beginning work on the victim, for in resuscitation cases "every second is an hour." The difficulty thus comes back to the general diffusion of proper knowledge and skill, so that every worker will be equipped when the time comes and if, therefore, his personal interest in the subject and in the study of the resuscitation rules is stimulated by the possibility of winning a medal, the great purpose of the plan will have been accomplished. And no one will deny the rightful pride with which such a token can be worn. There is one more point to add. Investigation of such hero cases would bring out a mass of practical data on the conditions and causes leading to these accidents, suggesting valuable precautionary measures for the future.

The Conflagration Hazard

When a widespread disaster such as fire or flood sweeps a busy American city the interval taken by its stricken populace to recover from the shock is largely measured by the speed with which local electric service can be resumed. The recent calamities of Dayton, Ohio, and Hot Springs, Ark., are cases in point. No better illustration could be given of the absolute necessity of electricity in the modern scheme of things than the general paralysis under which a community deprived of its energizing electric service labors. Lighting of streets and houses, operation of cars and newspaper plants, energy for telephonic communication, and often, as at Hot Springs, pumping of part of the water supply, are the pressing needs that wait upon the return of the current. Protection of the city, dismissal of militia and resumption of all the intricacies of commercial intercourse depend on the starting of the plant machines. Experiences like these, although infrequent, point out how, in selecting power-station sites, conflagration and flood hazards, however remote, should have careful attention in view of the vital and varied service which is more and more being rendered from the central-station buses. Most of the recently built turbine plants fulfil these conditions incidentally, for reasons of cheap real estate and alternating-current distribution, so that in the future destruction like that at Hot Springs (where an old power house was located in the midst of a thickly built and highly inflammable section) will be rare. But before dismissing the regrettable Hot Springs disaster a word of praise is deserved for the courageous plant operators who stayed behind to keep the electric pumps running, and for the undismayed and energetic management which, faithfully and with foresight, worked night and day to replace equipment and restore service.

The Present Status of Heavy Electric Traction

In his presidential address before the engineering section of the British Association for the Advancement of Science Prof. Gisbert Kapp gave a masterly and somewhat startling summing up of the work which has been accomplished in really large railway operation. So little has been done on main-line operation by electricity in America compared with the progress in railroading of the interurban class that one hardly realizes the aggregate importance of the equipment which has been put into service elsewhere. We do not hear day by day of roads working in Italy or Germany; we merely see a brief account of their initiation and then forget that they are going steadily on year after year to swell the list of successful electrifications. Everyone knows that for some years past the Italian government lines have been in course of conversion to electric traction with three-phase locomotives, but when one realizes that these locomotives in operation and under contract rise to the aggregate of about 200,000 hp it is clear enough, as Professor Kapp forcefully points out, that one has here no dubious experiment, perhaps soon to be abandoned, but a working method that has given good reason for continuous growth.

Likewise the now rather long list of electrifications on the single-phase system gives unmistakable evidence that in spite of oft-repeated tales of enormous unnecessary weights, rapid consumption of brushes, terrific heating and the like, the newer system has shown operative qualities that are of evident value. Well-advised governments and private corporations do not "blow in" millions on apparatus that cannot give a good account of itself. Likewise the recent work in relatively high-voltage direct-current traction has been uniformly successful and gives promise of permanent usefulness. Professor Kapp does not seem exactly enthusiastic about it, but very properly holds that there is no one system in traction which is quite suitable for all cases. Truth to tell, probably no small part of the hesitation of railway men about embarking in heavy electric traction has been due to the open abuse or damning with faint praise heaped upon each system by the advocates of the others. If one were inclined to cross a lake on his vacation and the skippers of the three available ferryboats bawled denunciation of the seaworthiness of their rivals' craft, the nearer shore would acquire added charm. The early lack of cordiality, to put it mildly, between the advocates of direct current and alternating current seems to have survived in the question of railroading when it has been forgotten almost everywhere else.

It is notable that the most important work in heavy traction is now being done by governmental action rather than by private initiative, especially in the electrification of existing lines; and this condition gives evidence perhaps of the real situation which one has to confront in looking forward. Once convinced that it is in the long run economical to adopt electric traction, a government operating its own railway lines can generally manage to raise the funds for the improvement. A privately owned line that has nearly reached the limit of advantageous credit by its flights in high finance, and that does not know when its employers may strike for higher wages or its rates be cut by the powers above, is not exactly in a position to pay the electrification bills even when the utimate advantage is clear. Professor Kapp does not discuss the details of this matter, but shows the great advances that have actually been made as indisputable evidence that the improvement is here in force and here to stay. Electrical enthusiasts may present estimates shaved down to the last conceivable limits in cost, and railway managers confronted by a demand for electrification may produce figures fattened out of all semblance of veracity, yet the long list of successful installations stands as proof that electrical traction in important lines is actually with us and showing the cause for its continuance. The systems may quarrel enough to damage their own interests for a while longer, as they are doing now, but sooner or later sound engineering must replace invective and then heavy traction will come into its own.

Lodge on Continuity

The presidential address of Sir Oliver Lodge before the British Association for the Advancement of Science is, in effect, the credo of an accomplished and original man of science regarding some of the fundamentals of physical knowledge. In its sympathetic study of some of the latest theories and discoveries it is illuminating, but its larger value lies in correlating these with the work that has gone before and the conceptions which have inspired it. Sir Oliver Lodge has been on the skirmish line of investigation long enough fully to realize that the battle cannot be won by a frontal attack but that its fate must depend on a series of turning movements, each, it is true, gaining ground, although seldom in the direct path forward. Such a turning movement is now under full way in the electrical theory of matter, the fundamental ideas of which are clearly set forth in his address. It bears much the same relation to the works of Faraday as did the researches of Hertz to those of Maxwell. And yet, as Lodge well shows, it does not touch the fundamental mystery that lies deeper than the electron.

It has long been evident that in some sense or other what people have been pleased to call electrical charge had the characteristics of a numerical coefficient—that it did not work in the infinitesimal differences required by the idea of continuity. It now turns out that the numeric is the enumeration of the electrons. And, whether we agree with the convention that the electron is electricity or hold that it is merely the minimum of matter with which a particular kind of strain is associated in amount proportional to its uniform mass, we do not yet know by what mechanism electric and magnetic forces interact. The old *"actio in distans"* problem confronts us to-day just as it confronted Newton, and Lodge turns to the continuity of the ether for the solution to-day just as he did when the atom instead of the electron was the fundamental unit. At the British association meeting twenty-six years ago Lord Kelvin, then Sir William Thomson, explained his theory of an ether possessing rigidity and elasticity in virtue of its dynamical activity like the water in the Niagara rapids. It remains for some one to correlate this conception with the action of the concentrated energy-points which we study as

electrons. But throughout Lodge adheres to that view of continuous action which regards continuity as the general case in the dynamics of the universe.

It is a long way from the center of force postulated by Boscovitch as the atom, through the vortex theory in its various phases, to the electron, and yet all of these lead in the same direction as to the phenomena and leave the final mechanism of interaction just about where Newton puzzled over it. The great forward step of this century is the gain that has come from getting a view of the electron —coming one step nearer to the real interrelations of matter—but still the need of a continuous medium confronts the investigator. As Lodge plainly shows, we are now going through a phase of the philosophy of negation such as has been known before in the history of science. But it has always hitherto proved to be only the time of halting to reorganize the forces of investigation for renewed activity. May this keen analysis of the field in its larger relations by a veteran like Sir Oliver Lodge open the way for another forward movement that shall carry science once more from the negative to the positive—even to the positive charge.

Electrical Cooking and Heating

Professor Morris' British Association paper on the subject of domestic electric cooking and heating, abstracted on a following page, discloses the results of a very practical test in which all the cooking and practically all the heating in a seven-room apartment was done electrically for an entire year, careful record being kept of the consumption day by day. As generally happens in the consideration of electrical heating, the hot-water problem was the serious difficulty, and in this instance it was met by giving up that part of the electrical program and putting in a coke-fired water heater. For the rest electric service worked out admirably, the average weekly consumption for cooking having been about 68 kw-hr. and for heating about two-thirds that amount, while the lighting was responsible for less than 5 kw-hr. The total yearly consumption was 2934 kw-hr. for cooking, 2068 kw-hr. for heating and 200 kw-hr. for lighting—in all, 5202 kw-hr. The total cost for the year is reported to have been approximately $122, including full allowance for the cost of coke and kindling wood. This appears economical enough until one is reminded that, beyond a standby charge aggregating about $32.50 for the entire year, the cost of energy was only 1 cent per kw-hr. This rate is not a rare figure in England of late, but where would Professor Morris have come out had he tried the experiment at American prices? To be sure, if his estimate of decreased domestic service is a fair one, a similar decrease at American wage rates would go far toward restoring the balance. We question whether such a lowered service cost can be depended upon, however, under average conditions in any country.

So far as energy consumption is concerned, the test was a representative one and the result may be looked upon as typical. Particularly instructive is the daily load curve, showing clearly the fact, now pretty well understood, that domestic load as a whole keeps well off the peak of the central station, which should be reason for encouraging special rates for such service. There is enough such heating and cooking work to be done to make it a very live issue where the local conditions permit low prices. One must not forget that an average English city has a much higher density of load than is reached by an American central station of similar output. But the acquisition of a big load for domestic use would tend to bring our load density to a figure that would make for much more economical distribution than now. Reducing the rates in the case before us to a straight meter basis, the equivalent figure of 1.62 cent per kw-hr. is not out of reach with a high density and good load-factor. Once bring electricity to the rank of a domestic necessity and surely interesting results will follow. In fact, the flat rate of $1 per person per month quoted in one American city comes out even a little better for a small family than a meter rate, and is near Professor Morris' figure for a family of five. So little has been done with heating as such, on anything but the smallest scale, that comparisons are difficult; yet it is clear enough that, with energy at or below 2 cents per kw-hr., electric heating is not at all out of the question, at least in fairly moderate climates. Further practical investigations like the one before us are needed to disclose the whole situation, At first glance it generally looks discouraging—probably to a degree quite unjustified by the real facts.

Protection of Buildings from Lightning

A very interesting report has recently been published by the *Verband Deutscher Electrotechniker,* of Berlin, on the means recommended for the protection of buildings from lightning. This report is full, detailed and compendious. Although lightning does not frequently strike one and the same building twice in the same year unless the building is very tall or exposed on elevated ground, yet since nearly every heavy thunderstorm involves one or more lightning flashes to trees or houses, the aggregate amount of damage done to buildings by lightning in the course of a year is very large. The number of persons killed by lightning in the United States in the year 1899, for which statistics were given by the Weather Bureau, was 563, with injuries to a yet larger number. The number of livestock killed that year in the fields was over 4000, the total damage to property by lightning being more than $3,000,000—figures surprising in their magnitude.

The original experiments and deductions of Franklin are referred to as the basis of all subsequent development in the art of lightning protection. It is pointed out that at least two ground connections and ground wires should be furnished in the lightning-protection system of any building. Wires of galvanized steel may be used where expense for metal must be kept to the lowest terms, copper being preferable, mainly on account of its greater permanence and weather-resisting powers. Lightning-conductor systems are divided into three parts—that which intercepts the lightning flashes, that which extends over and around the building, and that which leads into the ground. The report is perhaps the most comprehensive which has yet appeared on the subject.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Tungsten Lamps to Be Discussed by A. I. E. E.

At the meeting of the American Institute of Electrical Engineers to be held in the auditorium of the Engineers Building, New York, Oct. 10, the general subject for discussion will be tungsten lamps. Two papers will be presented as follows: "Tungsten Lamps of High Efficiency—I," by Mr. Irving Langmuir, and "Tungsten Lamps of High Efficiency—II," by Messrs. Irving Langmuir and J. A. Orange. The first paper will describe investigations into the cause of blackening of the bulbs of tungsten lamps and discuss methods whereby the blackening may be avoided and the efficiency of the lamps increased. The second paper will describe in detail the new types of high-efficiency tungsten lamps which have been produced by filling the bulbs with nitrogen vapor. These lamps in the larger sizes have an average specific consumption in the neighborhood of half a watt per candle-power, and it is expected some of these lamps will be shown in operation. At the close of the technical session the meeting will adjourn to the Institute offices on the tenth floor, where a smoker will be held and refreshments served.

Assessed Values of Ohio Properties

The valuation of electric light and power properties in Ohio for 1913 has been placed at $36,693,800 by the Tax Commission. This is an increase of $6,074,840 over the valuation for 1912. The increase in 1912 over the preceding year was also heavy. The Cleveland Electric Illuminating Company shows the largest increase, this year's valuation being $16,516,560 in comparison with $14,452,270 in 1912. It will be seen that the valuation of this company amounts to a large sum as compared with all the others in the State. It is possible that the valuation may be contested in the courts. The company's taxes on this valuation will be $31,996. The valuation of the property of the Dayton Power & Light Company was increased from $2,705,530 to $3,310,890; that of the Springfield Light, Heat & Power Company from $790,560 to $1,205,800, and that of the Youngstown Consolidated Gas & Electric Company from $3,149,370 to $3,373,880. A number of other companies had valuations increased in greater or less proportion to raise the total figures to a point that will produce the desired income to the State. Some remain unchanged and some have been slightly reduced.

Illinois Water-Power Conference

At the invitation of Governor Dunne a conference on the water-power situation in Northern Illinois was held at the State House in Springfield on Sept. 20. There were present representatives of the Sanitary District of Chicago, the Illinois-Michigan Canal, the cities of Chicago and Joliet and the Public Service Company of Northern Illinois. The Attorney-General of the State was in attendance and also a number of other gentlemen interested. The project under discussion was the construction of the proposed deep waterway from Lockport, Ill., where the Chicago Drainage Canal connects with the Desplaines River, in or near the Desplaines River and the Illinois River, to Utica, Ill., the head of navigation on the Illinois River. The proposal is to construct without delay that part of the waterway from the Sanitary District's hydroelectric generating plant at Lockport, Ill., through the city of Joliet, on the Desplaines River, to a point below Brandon's Bridge, a distance of about 3.5 miles. This would permit of the development of an important water-power. The estimated expense is $7,000,000. The question discussed was whether the Sanitary District of Chicago shall proceed with this work or whether the State shall do it under powers granted by the deep waterway constitutional amendment and the proposed bond issue of $20,000,000 by the State, which has been sanctioned by the voters.

The scheme proposed calls for the elimination of the hydroelectric plant in Joliet at Dam No. 1 of the Public Service Company of Northern Illinois, successor to the Economy Light & Power Company. It is reported that the Economy Light & Power Company is ready to abandon its water-power rights at the site mentioned, provided it is reimbursed. The company's lease expires in 1916. Litigation is now proceeding in relation to claims of the company to the river bank and adjacent territory in Joliet, and this complicates the situation somewhat. It is possible that the Governor will call a special session of the Legislature to consider the subject.

Neon Lamps

In the manufacture of liquid air by the process of Mr. G. Claude, of Paris, the so-called "rare gases" of the atmosphere are separated out. In a lecture on "Liquid Air and Its Uses," delivered at the time of the Chicago Refrigeration Congress, Mr. Claude said that neon is, perhaps, the most interesting of these gases. It is present in the air in perhaps one part in 66,000. It is produced as a by-product in the liquid-air oxygen apparatus of the lecturer. Neon, compared with atmospheric air, is an excellent conductor of electricity. Mr. Claude used the comparison that where 1000 volts are required for a given electrical transmission in air 13 volts suffice in the case of neon. This gave the speaker the idea of constructing with the aid of neon luminous tubes similar to those produced by Mr. D. McFarlan Moore, who used nitrogen. The light from these tubes is a bright red, but the inventor says that they have the advantage of much greater efficiency than the Moore nitrogen tubes, the relative consumption of electricity being given as about 0.6 to 1.7. Furthermore, the light is said to be of excellent quality from the point of view of visual acuity, contributing to sharpness of vision.

But the intense red of the light would hardly permit the use of these tubes for general illumination without correction to introduce some violet or blue. It happens that whereas the light of neon contains no blue, that of the mercury-vapor tube contains too much. Mr. Claude has made corrective tubes containing a little mercury. These tubes, when used in conjunction with the neon tubes, produce what seems to be a very satisfactory illumination as far as color effect is concerned. Without color correction, the tubes may be used in decorative lighting or as advertising novelties.

Pennsylvania Railroad to Electrify Suburban Line

The Pennsylvania Railroad Company announced on Sept. 24 that the board of directors had authorized the electrification of suburban service on the New York division to Chestnut Hill, a distance of 12 miles from Broad Street station, Philadelphia. The work, which will be completed by the fall of 1914, will involve an expenditure, including multiple-unit equipment, of $1,250,000. It has been determined that the electrification of the Chestnut Hill branch in connection with the electrification of the main line to Paoli offers the most prompt and effective plan, pending the further development of the company's final terminal plans, for congestion relief, since it is essential to obtain as quickly as possible greater train capacity in the present station at Broad Street. There are now eighty-five trains each day in and out of Broad Street station and sixty-six trains to and from the Chestnut Hill branch, all of which will be operated by electricity. It is very probable that the energy for the system will be purchased from the Philadelphia Electric Company, negotiations to that effect being still under way.

Record Run by Electric Roadster

One of the hits at the convention last week of the New England Section of the National Electric Light Association at Burlington, Vt., was the arrival of Colonel E. W. M. Bailey, of S. R. Bailey & Company, Amesbury, Mass., in an electric roadster after making the trip of 258 miles from Boston at an average running speed of 19 miles per hour. The run was made to test the performance of this type of car and nickel-iron battery over a route never before attempted by an electric automobile and in supposedly difficult country. The trip was made in a total running time of thirteen hours and thirty-five minutes, with a stock machine which has made 10,700 miles in demonstration service in the past eleven months. It was equipped with sixty cells of "A-5" Edison battery and received partial charges at rates of 30 amp to 150 amp at five points en route, only a short time being given per charge in most cases. The route presented many difficulties in the country sections in the way of heavy grades and uncertain road conditions. No adjustments or repairs of any kind were required or made on the way, nor was any attempt made to run the car an extreme distance on one charge. Colonel Bailey stated that the performance could be materially improved by repetition and said that, with provision for frequent short charges, cross-country touring by electric roadsters would, he felt sure, be found entirely practicable with present car designs.

Meeting and Convention Program of Electric Vehicle Association

In opening the regular monthly meeting of the Electric Vehicle Association of America at New York City Sept. 23 President Arthur Williams recounted his experience at the recent convention of the National Association of Corporation Schools at Dayton, Ohio, where the delegates were entertained at the factory of the National Cash Register Company. Throughout the session informality was the prevailing feature, and by engendering a round-table spirit freer exchange of ideas was fostered. President Williams stated that he hoped for similar informality at the coming Chicago convention.

The report of the secretary of the vehicle association showed an increase of approximately 125 members since last year, the total membership now being 428. The tentative program of the coming convention at Chicago was announced as follows: "Storage Batteries," by Mr. Bruce Ford, of Philadelphia; "Electric Vehicle Salesmanship," by a representative of the Baker Vehicle Company; "Why We Adopted the Electric Vehicle," by a representative of Gimbel Brothers, New York; "Electric Vehicle Tires," by Mr. F. E. Whitney, of Philadelphia; "Charging of Storage Batteries in Unattended Garages," by Mr. M. R. Berry, of Cleveland, Ohio; "The Merchant, the Central Station and the Electric Truck," by Mr. F. N. Carle, of Long Island City, N. Y.; "Co-operation Between the Electric Vehicle Manufacturers and the Central Station," by Mr. E. L. Callahan, of Chicago; a paper by a member of the Board of Fire Underwriters of Philadelphia, dealing with the effects of the electric vehicle on insurance rates; a paper, the title of which is not yet known, by Mr. Hayden Eames, of Cleveland, Ohio; a talk by Mr. Ralph Temple, of Chicago, on "Electric Vehicle Garages." An invitation has been extended to Dr. Pratt, of New York City, to deliver a lecture on the studies which he is making relative to the status of the truck in large cities. Announcement was made that a special train would carry the Eastern delegation to the convention.

The paper of the evening, presented by Mr. F. J. Ryan, of *The Commercial Vehicle*, reviewed the history of transportation from its beginning to the present day. The paper was general in its nature and dwelt upon the value of the commercial vehicle to the community in which it operates. General data on the number of times which merchandise is handled in its travels from producer to consumer were given. In the discussion, which was opened by President Williams, the following men engaged: Messrs. F. W. Smith, W. P. Kennedy, E. W. Curtis, Jr., E. P. Howland, F. N. Carle, Dr. Pratt, W. C. Andrews, H. C. Cushing, Jr., and G. H. Pride. It was stated that of the 5500 trucks now in use in New York City 2150 are electrically driven. Considerable debate was occasioned by the question of an annual tax which the city authorities are contemplating assessing upon all electric vehicles during the next year. The subject of cheaper electric trucks was also discussed and it was stated that the Ford Motor Car Company had recently concluded to build an electric vehicle which will compare in price and service rendered with the gasoline car which the company is now making.

Gas and Electric Merger Reports in Chicago

Reports from Chicago say that Mr. Samuel Insull, president of the Commonwealth Edison Company, and his associates will take control of the People's Gas Light & Coke Company of that city. A statement was issued from the office of one of the interests in the transaction saying that no merger of the properties was contemplated. The stock of the People's Gas Light & Coke Company has been advancing and various explanatory rumors in reference to this movement have been circulated. These culminated in the reports that the basis for the activity in the stock was the proposed assumption by Mr. Insull of the controlling position in the People's company. The latter company was controlled for many years by the late Anthony N. Brady and his associates. It is supposed that the stock held by the Brady estate would be transferred in any deal involving a change in control.

According to the reports now in circulation, Mr. Insull will be elected a director of the People's Gas company, together with Mr. John J. Mitchell, president of the Illinois Trust & Savings Bank, and Mr. James A. Patten. The People's company has $35,000,000 stock outstanding and about $55,096,000 bonds. The Commonwealth Edison Company now has an authorized capital stock of $50,000,000, the stockholders having been called together this week to authorize an increase from $40,000,000 to that figure. The amount outstanding was about $38,000,000, but a stock dividend of 10 per cent is to be paid from part of the newly authorized issue. The People's company restricts its service to gas.

British Association for the Advancement of Science

By Special Correspondent

From Sept. 10 to 17 there was held at Birmingham, England, one of the largest meetings for many years of the British Association for the Advancement of Science, the attendance being about 3000. The activities began with the admirable presidential address of Sir Oliver Lodge referred to elsewhere in this issue. The first paper in Section A was by Dr. C. G. Barkla, noted on page 564 of our issue for Sept. 20. Among the noteworthy features of Section G, Engineering, was the presidential address of Dr. Gisbert Kapp, discussed in this issue.

X-Rays as Light

Prof. C. G. Barkla put the X-rays squarely into line as light waves, obeying all the general laws of light but differing in their enormously short wave-length which makes all ordinary surfaces give diffuse reflection with them. Only crystal cleavage planes split as it were between layers of atoms are of such smoothness as to give regular reflection. The polarization phenomena quite correspond to those of ordinary light, and quantitative measurements show these conditions to be fulfilled. More interesting still, he had found somewhat homogeneous radiation quite characteristic of the metal bombarded, which obeyed the laws of fluorescent light, following Stokes' law that fluorescence drops to a longer wave-length than the exciting radiation, and giving the typical uniform distribution of intensity of ordinary fluorescence. Sir J. J. Thomson and Dr. E. Rutherford backed up his statements, and the former openly stated that these "characteristic" X-rays were one of the big discoveries of our generation.

Structure of the Atom

Then followed two papers by Sir J. J. Thomson and Dr. E. Rutherford respectively on the structure of the atom. Both were highly theoretical and agreed only in leading to Planck's law of radiation as their final end. The former investigator worked from certain mathematical fundamental assumptions, the latter from some experiments in radio-activity. Both theories may be regarded as first approximations to atoms built of positive and negative particles so related as to meet the general dynamical requirements of radiation, but so simple as to leave many phenomena quite unaccounted for. They were interesting studies which may serve as a basis for further work, but left all causal relations out of sight in much the way suggested in Sir Oliver Lodge's address.

Efficient Utilization of Fuel

From the standpoint of engineering an extremely suggestive paper was read in Section G by Prof. W. S. Burstall, who brought to the front the fact that burning coal in a furnace merely to yield heat was a disastrously uneconomical way of using it. Coal as we find it is a highly complicated substance, capable of producing many valuable products if these are not broken up by complete combustion. This is particularly true of fuels which from the ordinary standpoint are of low grade. In his judgment the way to treat fuel to extract the greatest value from it is by heating in closed retorts, not probably as in ordinary gas manufacture. If properly carried out, this would give a valuable series of fuel oils, medium density oils and even lubricating oils, together with gas for the direct production of power. Even the exhaust gases from the engines may be treated to obtain various other products. Owing to the fixing of certain arbitrary standards for gas, this economic series could not now be worked out. Once realize that from the larger viewpoint the quantity, quality and purity of the gaseous products obtained are really of only secondary importance and the problem of fuel utilization takes on a new aspect. Even lignite and peat may well be utilized. This paper gave in most effective form that larger view of fuel utilization of which so much has been heard in recent years, but which has hardly yet been presented in so striking an aspect. Professor Burstall's paper was not printed, a fact unhappily true also of the others which are here noted, but when it appears it will certainly be well worth the study of engineers. The fundamental point is that simple and complete combustion is not the way to utilize fuel if the maximum of value, rather than of heat, is to be obtained.

Radiation

The second day's proceedings opened in Section A with a long discussion on radiation, wandering into all sorts of theoretical bypaths, highly interesting, but not yet leading to any considerable increment of human knowledge. In fact, it reminded one of the witty characterization of metaphysics quoted in another section—that it resembled a blind man in a dark room looking for a black hat that was not there.

X-Rays and Crystals

Then followed the most sensational and far-reaching paper that the meeting disclosed—a discussion by Prof. W. H. Bragg of X-rays and crystals. This started from his beautiful work in determining the wave-length of X-rays by their reflection from successive cleavage planes of crystals, lying as they do at substantially atomic spacing. It is much akin to the use of an almost infinitely fine échelon grating, and, as his starting point, yielded 0.61×10^{-8} cm as the mean wave-length of the X-ray characteristic of rhodium, which was Professor Bragg's usual source. This given, it was a perfectly straightforward matter, although involving delicate experimentation, to determine the grating spaces, that is, the atomic cleavage distances found in examining crystals in general parallel to their various fundamental planes. The first thoroughly worked out was the diamond, and the results checked absolutely with the diffraction pattern obtained by passing a beam of X-rays through diamond. Zinc blende and fluorite were also attacked, the former showing clearly the relative loci of zinc and sulphur atoms, and the latter giving similar data. It looks very much as though a general method had been found for determining the space relations of the atoms in crystals. This gets at the very roots of stereochemistry, and if the method is effective it will give a new line of attack on the constitution of the atom which may throw much light on that fundamental problem. The point is that the X-rays, being only a few ten-thousandths the wave length of ordinary light, enable one to work down to the minute structure of matter.

Lightning and Lightning Protection

Sir Joseph Larmor then read an all-too-brief paper on lightning and lightning protection. The investigation was directed at the possible protective effect of a straight vertical rod or wire, and he showed as the result of his mathematical investigation of the distribution of potential that such a conductor was practically powerless to determine a lightning discharge or to do more than in a purely secondary way to ionize the air near its tip and give some conductivity. A big and high building, in his opinion, could disturb an area large enough to determine a discharge and the grounded conductor might then carry it off. For this function it should be well attached to metallic portions of the structure. It was the building and not the rod upon it which really facilitated the discharge. Sir Oliver Lodge added the comment that Sir. J. Larmor's theory agreed with the experimental facts.

The number of facts and data brought to light at the meeting is really extraordinary judged by American standards. This is attributed in part to the activities of the committees and partly to the relatively short distances that have to be traversed by those who attend the meetings. The activities of the association are well advertised throughout the city, the newspapers issuing placards an-

nouncing their special reports of the sessions. This plan counts for much in keeping up popular interest. The net result is that the meetings are well attended, the average for many years being nearly 2000, and the papers are of high quality. The meetings furnish a most effective lesson in the real importance that is attached to scientific and technical matters when they are fairly brought to public attention.

Illuminating Engineering Society Convention

The seventh annual convention of the Illuminating Engineering Society was held at Pittsburgh, Pa., Sept. 22 to 25. At the opening session of Monday morning, after brief addresses by Messrs. C. A. Littlefield, William H. Stevenson, President P. S. Millar and Vice-president Norman Macbeth, Prof. George A. Hoadley of Swarthmore College presented the society with an interesting historical gavel made up of parts which are significant in the development of artificial illumination in America. Mr. G. S. Barrows followed with the report of the committee on international co-operation, and Mr. F. N. Morton read the report of the committee on progress, which was discussed briefly by Professor Hoadley and Mr. V. R. Lansingh.

Progress Committee Report

An unusually complete and highly valuable report on developments in illumination science was submitted by the committee on progress, of which Mr. F. N. Morton was chairman. The report dealt with the numerous improved electric and gas lamps recently introduced, an outline being given of the predominating characteristics of each. The electric lamps included the drawn-wire tungsten, the tungsten alloy, and the 0.5-watt tungsten-nitrogen incandescent lamps; the magnetite and the long-burning flame-arc lamps, and the vapor-tube lamps described from time to time in our columns.

Considerable attention was paid to improvements introduced in photometry practice with special reference to work with sources differing in color. Much interesting information was given concerning street-lighting practice, new fixtures, globes and reflectors, legislation on illumination, and photography in illuminating engineering.

Incandescent-Lamp Improvements

In a paper by Messrs. Ward Harrison and Evan J. Edwards, Cleveland, Ohio, it was stated that since 1908 the strength of tungsten-lamp filaments has increased by more than 300 per cent. The greater strength permits operation at increased efficiencies at no decrease in total life. The use of chemicals in the bulbs, which has become general during the past year, has reduced the blacking of lamps to a marked degree, and it is therefore possible to operate them at efficiencies correct from the standpoint of total life with no shortening of the useful life. The performance of chemical lamps is not satisfactory when operated at low efficiencies. The use of chemicals has made possible a substantial reduction in the size of bulbs for several lamps. Decreased bulb size reduces the manufacturing costs and broadens the application of the lamp. During the past year lamp dimensions have been standardized in every particular. The average deviation from the standard is less than one-fourth that of a year ago. The introduction of the coiled filament makes possible many new forms of lamps which heretofore could not be manufactured. The strength of the filament is increased by this process and the candle-power maintenance is not affected. To the operation of helical filament lamps at high efficiencies and their use in small bulbs rather than poorer performance are to be attributed their comparatively low life ratings. The new tubular lamp and the focus type of lamp have many applications such as showcase lighting, use in projectors, stereopticons and the like.

The paper, which opened the afternoon session, was read by Mr. Harrison and was illustrated with lantern slides.

Discussion

A written discussion was contributed by Mr. L. T. Lewison, New York. Mr. V. R. Lansingh, Cleveland, Ohio, pointed out that the new helical-coil filaments will particularly simplify the design of reflectors depending upon specular reflection, whether prismatic or mirrored. Mr. J. C. Little, New York, urged complete standardization between the lamp and reflector. Mr. L. C. Porter, Schenectady, N. Y., described new fields of usefulness for the focusing-type lamp, among them use in theater spot-lamps, obtaining effects impossible with the usual arcs. Projection and moving-picture machines, signaling lanterns and locomotive headlamps were some of the other applications he mentioned. Dr. H. S. Ives, Philadelphia, Pa., commented on the photometric advantage of coiled filaments, but questioned their reliable operation at high voltages. Prof. J. W. Howell described the use of electric lamps in lighthouses and declared that improved units will replace present forms wherever electricity is available. Dr. L. S. Meyer, Bloomfield, N. J., predicted further great improvements in lamp construction and efficiency. Mr. Norman Macbeth, New York, urged standardization of the lamp specifications of the laboratories and suggested that the society advance this matter. Mr. L. E. Dunning, Bloomfield, N. J., declared that lamps which have become blackened and lost candle-power later seem to come back to normal brightness. Mr. J. R. Cravath, Chicago, questioned whether the coiling of the filament might not have a shading effect, lowering the lamp's output. Mr. G. H. Stickney, Harrison, N. J., explained that the energy received by the shading parts of the filament simply raises the temperature of the part struck, or is reflected off, in either case being available as useful light without loss. In closing the discussion, Mr. Harrison, one of the authors, explained that the difference in the characteristics of the old and new lamps chiefly affects their manufacturing data, with only very slight changes in the performance curves. Recent investigation has shown, said Mr. Harrison, that the useful life of a lamp depends entirely upon its performance characteristics and is independent of its energy cost or lamp cost. Discoloration, declared the speaker, would probably have little effect on decreasing the total light flux.

Leading-in Wires

The cooling effect of leading-in wires upon the filaments of tungsten incandescent lamps of the street series type was discussed in detail in a paper by Mr. T. H. Amrine, Harrison, N. J. As a result of an experimental study of the variation of the cooling effect with the leading-in material, the diameter and length of the lead wire and the size and material of the filament, the author concluded that the cooling effect is dependent mainly upon the resistance to heat flow presented by the leads and the cooled portion of the filament, the diameter of the filament and the maximum temperature of the filament, that is, the temperature of the uncooled portion. For lamps having lead and filament dimensions encountered in street series lamps the cooling effect decreases with increase of leading-in wire length, with decrease in lead diameter and with increase in thermal resistance of the material of the lead. With lamps having the same lead construction but with filaments of different diameters the cooling effect shows a maximum at a value of filament diameter which is dependent upon the lead construction used.

Street-Car Lighting

Mr. S. G. Hibben, Pittsburgh, Pa., in a paper on modern practice in street-railway illumination, claimed that carbon lamps are no longer advisable for street-railway service on account of short life and high consumption. Tungsten lamps in 94-watt and 56-watt ratings seem to be the most

economical. Lamps now on the market, when equipped with proper downward reflecting shades, enable the energy cost for lighting to be cut in half, at the same time allowing an increase in the usable light of more than 80 per cent. Special fixtures are available for supporting the shades, and selector switches may be employed to insure continuous lighting service of series burning lamps. More steady illumination is secured by the new system of lighting, under the adverse conditions of voltage fluctuations. The glare that exists at present in the majority of electrically lighted street cars is done away with through the medium of the shades.

Discussion

Mr. L. C. Porter, Schenectady, N. Y., commented on the greater flexibility and better distribution of the 56-watt lamp for car-lighting. When wired in two circuits, an outage failure causes less inconvenience than with the 94-watt lamp. Mr. E. B. Rowe, Cleveland, Ohio, contended that structural features of the lamps were of even greater importance than occasional outage troubles. Others who spoke briefly were Messrs. R. B. Ely, Philadelphia, Pa.; G. H. Stickney, Harrison, N. J.; J. B. Jackson, Chicago, Ill.; V. R. Lansingh, Cleveland, Ohio, and T. G. Hibben.

Psychological Values of Light and Color

At the session of Tuesday morning the first paper read was that on "The Psychological Values of Light, Shade, Form and Color," by Dr. F. Park Lewis, Buffalo, N. Y., who is president of the American Association for the Conservation of Vision. In his discussion Dr. Lewis pointed out the fact that all sense interpretations are essentially psychological processes and declared that scientific exactitude is true only in its individual interpretation. He then spoke of the application of light in its social and civic aspects, insisting that proof has been positively established that bad lighting is responsible for poverty, since poor illumination and bad vision reduce human efficiency. He also made a plea for a national organization of architects, illuminating engineers, physicians and public-spirited men to collaborate on better lighting for public buildings.

Dr. Lewis's address was warmly commended by President Millar, Dr. Ives, Dr. M. G. Lloyd, Chicago, and Mr. G. H. Stickney.

Efficiency of the Eye

Dr. C. E. Ferree, Bryn Mawr, Pa., reported the results of an experimental determination of the conditions affecting the ability of the eye to maintain its efficiency for continuous work. He found the distribution of the light to be the fundamental factor that most influences the welfare of the eye. If, for example, the light is well distributed in the field of vision and is diffuse, tests seem to indicate that the efficiency of the eye, so far as the problem of lighting is concerned, is practically independent of intensity. That is, when the proper distribution is present, intensities high enough to give the maximum discrimination of detail may be employed without causing appreciable damage or discomfort to the eye. For the kind of distribution given by the majority of lighting systems in use at the present time the tests showed that unquestionably too much light is being used for the welfare and comfort of the eye.

Dr. Ferree's paper occasioned much discussion and brought out several dissenting opinions. Among those who spoke were Drs. Ives and Lloyd and Messrs. L. B. Marks, New York; M. Luckiesh, Cleveland, Ohio, and W. Pierce, the consensus of opinion being that the author had not been specific enough in his statements and had not given sufficient data. Dr. Ives in particular urged more specific use of terms and definitions. In reply to his critics, Dr. Ferree defended his illuminating-engineering equipment and methods and declared he had included in the paper all the information he supposed necessary. The systems which he investigated were, he claimed, selected at the suggestion of qualified illuminating engineers and installed in such a way as to render the results truly comparative. The advocates of the direct, the indirect and the semi-indirect systems being equally dissatisfied with the results, he concluded that probably none of the systems had received decided advantage over the others.

At the suggestion of Mr. Lansingh, it was voted to refer Dr. Ferree's paper to the research committee to obtain its co-operation in the future work of investigation by Dr. Ferree.

Production of Light

Some theoretical phases of light production were discussed in a paper by Mr. W. A. Darrah, Pittsburgh, Pa. The author set forth some of the inherent limitations of the various electric illuminants now in use and outlined the effect of these limitations upon the progress of the art of illumination. The basic theory of light production by the acceleration of electric charges was analysed with a view to indicating the relative possibilities of the various types of illuminants, particularly the arc and the incandescent lamp. The structure of the atom was considered in the light of modern theories, and some general deductions were made regarding the properties which a substance is likely to exhibit if well adapted for use as a radiating body. A tentative explanation of the action of selective radiation was given, and of the part which this phenomenon plays in present illuminants. It was demonstrated that to secure high luminous efficiencies selective radiation must be relied upon, and therefore unless new materials are discovered which exhibit selective radiation while in the solid state, the efficiency of the electric arc will remain materially higher than the efficiency of the so-called incandescent lamp, where electrical energy is transformed into heat and then into light by means of the resistance of a conductor. Mr. Darrah remarked that the vapor-conductor type of illuminant, as for instance the flame arc and the metallic arc, has only begun to approximate its possible efficiencies and therefore has a very large field ahead of it.

Hospital Lighting

Many lighting units and arrangements that have proved satisfactory in hospital service were described in a paper by Mr. William S. Kilmer, New York. In the operating room use is made of a lighting system capable of producing an illumination intensity of not less than 25 ft.-candles. In the wards glare must be carefully avoided. For this purpose indirect-lighting fixtures have given good results.

The Tungsten Lamp

In his paper on current developments in the manufacture of incandescent electric lamps, Mr. J. W. Howell, Harrison, N. J., stated that a difficulty encountered with thin-filament lamps is their breakage; with thick-filament lamps, the blackening of the bulb. Fragility has been overcome by using ductile tungsten filaments and blackening by means of so-called "vacuum getters." He showed test data indicating that a 110-volt lamp operated at 0.9 watt per candle gives 900 hours' life with only 1 per cent decrease in candle-power. He also showed the results of tests on a 400-watt lamp operated at 1.01 watt per candle for 6000 hours. The life depends upon the specific consumption at which the lamps are run. The aim is now to obtain a commercial life of 1000 hours in all standard tungsten lamps, the consumption being adjusted to produce this result.

Mr. Howell claimed that manufacturing processes have been so far developed that practically absolute accuracy is now obtained in the rating of lamps. The filament diameter is so closely uniform that such seeming differences in the photometric measurements of different lamps of one rating are found to be attributable to inaccuracies in the photometers. In other words, lamps as manufactured in immense quantities are accurately uniform to a degree within the limits of error of photometric measurement.

In discussing the so-called "half-watt" lamp, Mr. Howell

said that the nitrogen which surrounds the tungsten filament and is introduced at atmospheric pressure has several effects. Its chief disadvantage resides in the fact that it cools the filament by conduction. This effect is greater the smaller the filament, hence only large filaments are used in order to obtain high efficiency. A 12-amp filament consumes 0.5 watt per candle, while a 20-amp filament consumes only 0.4 watt per candle. He exhibited a 3-amp, 0.6 watt per candle lamp giving about 500 cp, and also a 20-amp, 110-volt, 2200-watt lamp giving about 5000 cp. The latter has the largest output in candle-power ever obtained in a single incandescent unit. Mr. Howell stated that 10,000-cp incandescent lamps can easily be produced in case a demand arises for lamps of this enormous output.

The meeting of Tuesday evening was held in Soldiers' Memorial Hall, the remarkable lighting effects of which have been described in these columns. Following the technical program, Mr. Henry Hornbostel, architect for the building, demonstrated the illumination effects producible with the auditorium equipment and spoke briefly on the topic of appropriate lighting for the home, office, theater, church, etc., pointing out that artistic considerations are often more important than mere efficiency.

The Neon-Vapor Lamp

The neon-tube lamp was described and demonstrated by its inventor, M. Georges Claude, Boulogne, France. The properties of neon are very remarkable, its spectrum being excellent although it contains no blue lines. However, neon is very sensitive to the presence of small quantities of other gases, being annihilated by them. To overcome this difficulty, the author utilizes charcoal, cooled by liquid air, to absorb the gases.

In comparison with the Moore nitrogen-tube lamp the Claude neon-tube lamp requires one-third the operating voltage, say 800 volts for a 6-m tube. It gives, say, 200 candles per meter instead of 60, and its specific consumption is 0.6 watt as compared with 1.7 watts per candle.

The light of the neon lamp is too red. To correct this disadvantage use is made of mercury tubes placed near the neon tubes and operated with the same current. In this way a very agreeable illumination is obtained at a total consumption of from 0.8 watt to 0.9 watt per candle.

The speaker exhibited five neon tubes, each 12 ft. in length. Two, containing pure neon, produced red light, and the three others, containing a mixture of neon with other gases, gave a bluish color.

Mr. D. MacFarlane Moore, inventor of the Moore tube lamp, a number of which are used in the lighting of the Soldiers' Memorial, followed M. Claude and described the work done in America in the development of vacuum-tube lighting systems. He expressed hope that some other gas might be found with equal light-giving efficiency but a better color than neon.

Quartz-Tube Mercury-Vapor Lamp

Much interesting information concerning the quartz-tube mercury-vapor lamp was given in a paper by Mr. W. A. D. Evans, Hoboken, N. J. The author explained the difference between the glass-tube and the quartz-tube mercury-vapor lamps and gave some facts on the characteristics of quartz, also as to the construction of the burners. A description was given of the various types of lamps manufactured. The color of the light from the quartz lamp is similar to that from the standard tube lamp with a certain amount of red added, giving a closer approximation to daylight. The wide application of the lamp in the industrial field was shown by figures from a few installations. Figures were given as to the maintenance cost of the lamp. While the lamp has been developed as an illuminant, it plays also an important part in the chemical and physiological world owing to the ultra-violet radiation. Considerable experimenting is being done at the present time to determine its availability in processes where sunlight is a factor, and new methods have been worked out and new fields opened up for the bleaching of cotton and vegetable fabrics, testing the permanency of colors, deblooming oil, and in physiological and photographic work.

The paper by Mr. Evans followed Mr. Moore's address, being read in abstract by Mr. Berford Brittain in the author's absence.

Mr. Roscoe E. Scott, Cleveland, Ohio, closed the evening's program with a paper on "The Evolution of the Lamp," illustrated by lantern slides. His remarks traced the history of illuminants from the pine-knot to modern high-efficiency units.

On Monday evening a reception was tendered to President and Mrs. P. S. Millar. Dancing followed, the Westinghouse orchestra furnishing the music. There was no session on Tuesday afternoon, the delegates being taken on special cars to the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company.

The registration at the convention numbered over 250. From the New York Section alone more than fifty members were present.

The papers presented at the remaining sessions, together with the discussion they provoked, will be reported in a following issue.

Iron and Steel Electrical Engineers

The seventh annual convention of the Association of Iron and Steel Electrical Engineers was opened at the Hotel McAlpin, New York City, Sept. 27, 1913, with a business meeting in which the reports of the various committees were presented. The report of the membership committee showed an increase of thirty-eight associate members and thirteen members, making the total membership of the society 253. The treasurer's report indicated that a 40 per cent increase in yearly dues had been made.

Carbon Brushes

The first paper of the afternoon, "The Selection and Operation of Carbon Brushes," by Mr. W. P. Poynton, sales manager for the W. J. Jeandron Company, reviewed the history of carbon-brush manufacture and operation from the year 1895 to the present date. The author gave general rules for the selection of brushes to suit different conditions met in practice and dwelt especially upon brush troubles met by the rolling-mill operating engineer. In conclusion, the advice was given that first cost of brushes be made secondary to total operating cost of machines, for while the cheaper brushes may wear for a long period, they do so at the expense of the commutator.

Mr. Poynton's paper was discussed by Messrs. C. S. Proudfoot, Munhall, Pa.; B. G. Beck, Gary, Ind.; F. H. McDowell, W. D. Stevenson and C. L. Corbett, Pittsburgh, Pa.; B. W. Gilson, Youngstown, Ohio; J. Farrington, Steubenville, Ohio; W. Jones, Cleveland, Ohio, and E. Friedlaender, Braddock, Pa. The discussion brought out the opinion that no one type of brush could be made to give satisfaction under all operating conditions. The experience of the majority of the members seemed to indicate, however, that the better grades of brushes were less expensive in the long run.

Magnetic Control

In a talk on "Alternating-Current and Direct-Current Magnetic Control" Mr. M. A. Whiting, of the General Electric Company, showed lantern slides displaying characteristic curves of different types of motors and generators used in rolling-mill service. By the use of curves and diagrams the advantages and disadvantages of employing machines under certain conditions were pointed out with particular reference to the control problems involved. The author showed that two series motors with different speed characteristics mechanically connected together will operate more satisfactorily than will two shunt motors with a like

difference in their inherent speed. The talk was concluded with a brief explanation of the application of speed time curves as an aid in the correct selection of motors for table operation. No discussion followed the paper.

Direct-Current Turbo-Generators

At the Tuesday morning session of the convention the paper on "Herringbone Gears for Steel Mills," by Mr. P. C. Day, was postponed, as the author was expected to arrive during the week on the *Mauretania* in time to present the paper in person. Mr. H. A. Rapelye, of the Westinghouse Electric & Manufacturing Company, in his paper on "Direct-Current Turbo-Generators," discussed the feasibility of several methods for using turbines where direct current was the ultimate product desired. According to the author, the most satisfactory solution is found in the use of the helical reduction gear with the floating-frame construction. Lantern slides showed the construction of the floating frame and several installations of reduction gears now in use with direct-current generators.

The paper was discussed by Messrs. W. E. Stevenson, of Pittsburgh, Pa., and F. A. Wiley, of Chicago, Ill.

Standardization Meeting

Following the discussion of Mr. Rapelye's paper the meeting was placed in the hands of Mr. F. D. Egan, chairman of the committee on standardization, who called for discussion from the members relative to general specifications for electric cranes, transformers and automatic controllers. Experiences with electric-crane operation were recounted by Messrs. O. R. Jones, Youngstown, Ohio; E. Friedlaender, Braddock, Pa., and F. D. Egan, Midland, Pa. The most recent developments were explained and illustrated by the use of lantern slides. In the discussion the following took part: Messrs. W. F. James, Philadelphia, Pa.; H. F. Stratton, Cleveland, Ohio; M. A. Whiting, Schenectady, N. Y.; C. T. Henderson, Milwaukee, Wis., and W. O. Lum, Pittsburgh, Pa. It was brought out that any attempt to standardize details of mill apparatus would meet with universal dissent. However, it was admitted that the constructive policy of making standard general specifications, which would in no way limit or hamper the designer in the development of apparatus, would tend to lessen the troubles of the mill operators and was a work which the committee on standardization should undertake with zeal.

Switching Devices

A paper on "Recent Developments in Switching Devices for Power Circuits," by Mr. T. H. Mahoney, of the Westinghouse Electric & Manufacturing Company, dealt with carbon circuit-breakers, air-break switches and oil circuit-breakers. The general trend of design was pointed out and illustrated with photographs showing the most recent types of each class. No discussion followed.

Lifting Magnets

In the absence of Mr. B. E. Fernow, Jr., the paper on "The Design and Use of Lifting Magnets" was read by Mr. C. T. Henderson. Circular and bipolar lifting magnets were compared and data given which showed the circular magnet to be better adapted to handling scrap and open-hearth stock than the more recently developed bipolar type of magnets. Figures presented in the paper showed that the trouble experienced by the operators of lifting magnets was confined almost wholly to minor mechanical features and to wearing out of the current-carrying leads. The author quoted data from tests showing that pig iron can be loaded from a stock pile in the charging boxes by the use of lifting magnets for a trifle less than 2 cents a ton.

In the lively discussion which ensued the following men took part: Messrs. E. Friedlaender, of Braddock, Pa.; H. F. Stratton, Cleveland, Ohio; R. Tschentscher, South Chicago; K. H. Cederlund, Duquesne, Pa.; E. H. Wentz, Lorain, Ohio; W. T. Snyder, McKeesport, Pa.; C. T. Henderson, Milwaukee, Wis.; J. C. Reed, Steelton, Pa.; O. R. Jones, Youngstown, Ohio; C. W. Parkhurst, Johnstown, Pa.; G. W. Richardson, Philadelphia; T. E. Tynes, Buffalo, N. Y.; J. Herrington, Steubenville, Ohio; M. A. Whiting, Schenectady, N. Y.; W. F. Detwiler, Tarentum, Pa.; F. H. Woodhull, Coatesville, Pa.; F. H. Kittredge, Joliet, Ill., and C. Pirtle, Cleveland, Ohio. A written communication from Mr. A. C. Eastwood was read in his absence by Mr. F. R. Fishback, Cleveland, Ohio. It was evident from the discussion that the final word regarding the relative merits of the bipolar and the circular magnets has not yet been spoken. Mr. Eastwood's communication told of an installation where a saving of 30 per cent had been effected through the substitution of a 30,000-lb. skull cracker for a 15,000-lb. ball. It was stated that the increased weight made it necessary to lift the ball to only one-half its former height and that the speed of the lift was not seriously impaired by the added weight.

Mercury-Vapor Quartz Lamp

At the afternoon session the paper which had been prepared by Mr. W. A. D. Evans on "The Mercury-Vapor Quartz Lamp" was read in his absence by Mr. M. B. Buckman. The author explained the difference between the standard mercury-tube lamps and the quartz mercury-vapor lamps, giving interesting facts and figures on the characteristics of quartz and the construction of the burners. A description was given of the various types of lamps, together with explanatory drawings and photometric curves. A few installations were described and the many industrial uses of the lamp were pointed out. It was stated that at present a 220-volt lamp of this type can be operated at a cost of from $4 to $5.50 per 1000 hours.

The paper was discussed by Messrs. D. M. Petty, South Bethlehem, Pa.; J. H. Reniers, Pittsburgh, Pa.; F. H. Woodhull, Coatesville, Pa., and W. T. Snyder, McKeesport, Pa. All of the speakers who have been using this type of lamp report that it is giving entire satisfaction and is furnishing cheaper illumination than was possible with previous systems.

On account of the absence of Messrs. Ward Harrison and H. H. Magdsick, the "progress" report on illumination was held over for the Thursday sessions.

Entertainment Features

The time of the visiting ladies was well taken up during the week by automobile trips and theater parties. Trips were arranged Wednesday afternoon to the Brooklyn Navy Yard for those members who did not care to attend the meeting of the National Council for Industrial Safety, which held its second congress in conjunction with the convention of the Iron and Steel Electrical Engineers. The annual banquet of the two societies was held at the Hotel McAlpin Wednesday evening. Gov. John K. Tener of Pennsylvania was toastmaster. Howard Elliott, president of the New York, New Haven & Hartford Railway, and George W. Perkins, who were invited to speak, were unable to be present, but telegraphed their indorsement of the safety movement. Former Representative James T. McCleary of Minnesota, S. W. Tener of Cleveland and L. H. Burnett, of the Carnegie Steel Company, spoke. Mr. McCleary's speech was an attack on demagogy and a plea for real leadership.

Election of Officers

The result of the election of officers for the ensuing year, as announced by President C. W. Parkhurst, is as follows: President, Mr. E. Friedlaender, Braddock, Pa.; first vice-president, Mr. O. R. Jones, Youngstown, Ohio; second vice-president, Mr. R. Tschentscher, South Chicago, Ill.; secretary, Mr. W. T. Snyder, McKeesport, Pa.; treasurer, Mr. James Farrington, Steubenville, Ohio.

In a latter issue of the *Electrical World* abstracts of the remaining papers and discussions will be given.

Convention of the Pennsylvania Electric Association

The sixth annual convention of the Pennsylvania Electric Association (State branch of the National Electric Light Association) was held at the Water Gap House, Delaware Water Gap, Pa., Sept. 16, 17 and 18. The features of the sessions on Sept. 16 and 17 comprising President Van Dusen Rickert's address and the addresses of Mr. J. B. McCall, president of the N. E. L. A., and the Hon. Frederic W. Fleitz, of Scranton, Pa., were published in last week's issue.

MEMBERSHIP

According to the committee on membership, the association now comprises 77 Class A members, 1230 Class B members, 24 Class D members, 35 Class E members and one honorary member, making a total of 1367. The association lost eight Class A members during the year owing to consolidations, yet it still remains the banner geographical section of the national body.

LAMP COMMITTEE REPORT

The lamp committee report, presented by Mr. W. W. Cloud of Philadelphia, Pa., traced the developments and improvements in the incandescent lamp during the past year. From information obtained from the manufacturers the committee reported that they will shortly adopt a single-voltage rating for tungsten lamps. After discussing the operating characteristics of incandescent lamps the committee took up the question of drop due to interior wiring, and it is its recommendation that every central station give careful consideration to the problem of drop, since it may be possible to improve the service and at the same time show an increase in revenue. A reduction in the price of tungsten lamps, together with the improvement in quality, also calls for the serious attention of central-station managers as to the most desirable manner in which the consumer shall obtain the lamp. Whether lamps are given free or sold at a reduced price, the committee feels that the consumer should be encouraged to obtain his lamps from the central station so that the central station may have some influence over the voltage and wattage of lamps selected.

Discussion

Messrs. C. W. Bettcher of the General Electric Company, F. M. Noecker of Renovo, E. F. McCabe of Titusville, O. P. Anderson of the General Electric Company, H. P. Liversidge, T. Sproule and W. W. Sproule of Philadelphia, A. P. Schneider of Allentown, Van Dusen Rickert of Pottsville and C. W. Bears of Wilkes-Barre joined in the discussion of the lamp committee's report. The consensus of opinion was that regulation of lighting circuits should receive attention inasmuch as lighting companies sell service and if the light is not up to standard the service is unsatisfactory and the consumer has cause for complaint.

WELFARE WORK

The committee on welfare work, of which Mr. H. Harris of Wilmerding is chairman, said that the national body is entitled to the credit of calling the attention of member companies to the important matter of employees' welfare and for making recommendations far more liberal and advanced than any advocated by larger employers of men in other industries. The main purpose of the committee's deliberations was to interest the smaller companies sufficiently to organize without further delay either by separate company plans or through mutual organizations of member companies. The committee forecast the enactment of a compensation act by the State and suggested that companies give some consideration to the preparation of such a law. The broad questions of welfare were discussed under the following heads: Safety of employees by the prevention of accidents and all diseases; compensation for disability or death due to accident and to other causes; service annuities; saving and investment funds; vocational education, and physical improvement. In view of the legislation everywhere urged, the committee said it must be apparent that sooner or later it will become necessary for companies to exercise more care in the selection of the men entering the service, since otherwise the industry will become burdened with the results of the careless acts of incapables who should seek employment where the possibility of damage to costly apparatus and of serious or fatal injuries to co-employees is less than in central-station work.

In discussing educational work carried on by many of the large companies and welfare work, the committee appreciated the impossibility of any very extensive developments by separate companies except through group work by N. E. L. A. sections or by the utilization of the facilities of existing correspondence school courses. The committee submitted for consideration the idea of establishing correspondence courses covering such branches of the industry as require men specially trained. Every inducement should be offered to employees to engage in healthy indoor and outdoor recreations which will build up the physical structure and keep both body and mind in that healthy condition so necessary to the employees of an ever-growing industry, aiming to render the best possible service to an exacting public.

Discussion

A rather interesting and lengthy discussion followed the presentation of the report. Messrs. E. D. Dreyfus of Pittsburgh, H. Harris of Wilmerding, E. H. Davis of Williamsport, W. Partridge of Clearfield, J. M. Wakeman of New York and W. R. Kenney of Connellsville took part. Mr. Davis called attention to the stringent provision of factory laws and to the necessity of companies insisting upon physical examination of employees in advance of the passage of such laws. He told of the methods employed by his company in dealing with the bereaved and afflicted families of employees. The company pays the funeral expenses and makes some compensation to the family irrespective of its liability, etc. Mr. Dreyfus called attention to the schools of the Commonwealth Edison Company and the New York Edison Company and suggested that a condensed course be taken therefrom for the benefit of the smaller companies. Mr. Harris proposed that a course be developed by the company sections or the national body which could be standardized and put within reach of everybody in the industry. Mr. J. M. Wakeman gave a very interesting account of European observations of liability laws and said that the companies here must work out a plan for injured and disabled employees or otherwise more drastic measures would be thrust upon them by the government. In this legislation labor leaders play quite an important part, with the result that the best thought is lacking and the laws are very stringent. Mr. Kenney praised the lectures available to members of the National Electric Light Association and also the work of correspondence schools. He suggested that if the companies would get classes together special rates could be obtained from the correspondence schools and an instructor sent to the class at times. He also advised companies to place at the disposal of their employees books on the electrical subjects and also technical journals. The latter should be available at the homes of the employees so that they could be exhaustively read. All work of this kind, he said, resulted in a lasting benefit to the central station through more intelligent employees.

STREET LIGHTING

Messrs. Preston S. Millar, president of the Illuminating Engineering Society, and Norman D. McDonald gave a very interesting paper on street lighting, prefacing their remarks with a description of the general conditions which existed up to the beginning of the last decade. The 4-amp metallic-electrode arc lamp has been widely used during the past few years and is expected to be a very acceptable lamp for street-lighting purposes, replacing the open and inclosed carbon-arc lamp. The 6.6-amp lamp of the same type forms an acceptable substitute of higher power and

in its adapted form for "white way" lighting is meeting with much favor. The inclosed flaming-arc lamp, upon the development of which manufacturers have specialized for the last few years, has hardly emerged from the development stage, so that no prediction can be made as to the place which the long-burning inclosed flaming-arc lamp will find in street-lighting practice. The quartz lamp which has been proposed for street-lighting purposes has not as yet been employed widely enough to afford adequate information as to its qualities. The tungsten lamp extended the field for electric service for street lighting by providing a satisfactory efficient illuminant which competes successfully against gas mantle lamps. The series tungsten lamp is giving satisfactory service and the multiple tungsten lamp is being employed in some cities as a competitor of the gasoline mantle lamp for lighting parks, etc. Among the most recent developments is the invention of the tungsten lamp of high power for series and multiple lighting, and it remains to be determined what effect this half-watt lamp will have upon street-lighting practice. Assuming it to be a reliable and satisfactory illuminant, the authors said it would appear to be a formidable competitor of the arc lamp. It is understood that arc-lamp manufacturers are looking to the use of high currents as a means of increasing the efficiency of arc lamps, so that all of the most recent developments point to much higher-powered illuminants for the near future. The authors called attention to the gradual increase in the intensities of street lighting throughout the country and went deeply into the subject of tests of street illumination, glare and the contractual aspects of street lighting. The intensities of illumination of street service, in foot-candles, were given by the authors as follows: Principal streets and cities, 0.25 to 1.0; important side streets, 0.1 to 0.25; resident streets, 0.1 to 0.05; suburban roads, 0.01.

As a standard for comparison of these intensities, it may be stated that bright moonlight is of the order of 0.015 horizontal ft.-candle.

Discussion

The paper on street lighting was discussed by Messrs. T. Sproule of Philadelphia, G. H. Stickney of Harrison, N. J.; G. E. Wendle of Williamsport, E. D. Dreyfus of Pittsburgh and Van Dusen Rickert of Pottsville. Mr. Sproule told of the various conditions which had to do with the placing of lamps on the public streets and asked the authors to recommend some reliable method of measuring the illumination of a lamp on a street rather than in a laboratory. He also desired to know if it is possible to get a specification covering gas, oil, incandescent and arc lamps that would be equitable to all. He said that the characteristic curve of an arc lamp bears some relationship to the total life flux, so that it ought to be possible to determine the illumination by a measurement in one direction. Mr. Sproule also suggested that tests made of arc lamps be spread over a length of time. Mr. Stickney emphasized the importance of the street-lighting question to the central station, since disagreements regarding the light and rates result oftentimes in the city giving a franchise to a competing company whose very existence depends upon its ability to secure the city lighting franchise. It is through disagreements over street lighting that openings are made for competing companies to get a foothold in territory already served by a central station.

Mr. Wendle called attention to the difficulties confronting a central station in combating complaints regarding the quantity of light delivered to the city on contract. It was the contention of Mr. Dreyfus that refinement in street-lighting contracts should be confined to companies operating in large cities and that in small cities possessing minor installations a simple commercially designated lamp should suffice as standard. Answering a number of questions, Mr. Millar said that glassware varies in quality so that its absorption could not be stated accurately within 20 per cent. He contended that the description of the lighting unit as called for by the N. E. L. A. specifications was intended for the protection of the central station, and that no common specifications could be drawn up for gas, oil, incandescent and arc lamps. He also stated that lighting companies should have a voice in drawing up the specifications for city street lighting, and that where improvements are made in lamps the central station should see that the municipality got its proper share of the saving effected.

Feeder Regulators

The increasing use of energy as well as the tendency for central-station combinations result in an increasing variety and length as well as complexity in transmission and distribution systems, so that the question of the steadiness of voltage at distributing centers is of importance. Probably no other feature tends to create dissatisfaction with central-station service more easily than wide fluctuations of voltage, resulting in proportionate variations in candle-powers of lamps, speed of motors, etc. In a paper on feeder regulators prepared by Mr. A. D. Fishel, of the Westinghouse Electric & Manufacturing Company, the economies attending the use of automatic regulating equipment were outlined and the various types of regulators for feeder circuits described in detail. Although the single-phase feeder regulator has at present the widest application, there has been a specific increase in the use of polyphase feeder regulators during the past two or three years.

Discussion

Mr. H. P. Liversidge, of Philadelphia, touched briefly on the single-phase regulator, commenting on its size as compared to the switchboard and the importance of its noiseless operation in residential districts, where substations in which such regulators are used are in a great many cases located. Mr. Fishel pointed out that in the newer designs the humming noise is greatly lessened and that the floor space taken by the regulator is necessary in order to obtain rigidity and to eliminate the humming.

Rates

In a paper on this subject Mr. L. H. Conklin, of Scranton, said that the time has now come when central stations have not only themselves to consider but the regulating public as well. The rate research committee of the N. E. L. A., he said, found that it was quite impossible to make much headway by discussing the question of rates as a whole, although it found that the disagreement had to do with language and not with facts. He suggested that if attention be directed toward the standardization of forms the differences will become less and finally simmer down to questions of fundamentals. Mr. Conklin pointed out the difference between rates and rate of return, stating that if the community is to have full value in service and the stockholders a full return on the money invested, the rates must be adjusted between classes of business so as to get the fullest contribution from each class. Classes may be made from a value of service standpoint, load-factor or off-peak use. The central-station industry, he maintained, must educate itself and the public as well to recognize that anything which results in good to all is neither discriminatory nor unfair, and if service is sold to any class for less than it is worth to that class the burden falls on some other class.

Discussion

A very general discussion followed the reading of the paper, Messrs. E. H. Davis of Williamsport, E. D. Dreyfus of Pittsburgh, H. J. Harris of Wilmerding, G. E. Wendle of Williamsport, L. H. Conklin of Scranton, A. P. Schneider of Allentown and J. Murphy of Renovo participating. The speakers bore testimony to the value of the rate research committee's work and the valuable information given in the "Rate Research Bulletin."

RULES AND REGULATIONS FOR OPERATORS

Two papers were read at the closing session, one by Mr. Ira G. Walborn of Pottsville on "Rules and Regulations for Station Operation" and the other by Messrs. S. W. Brown and J. A. Metz of Hazleton on "Rules and Regulations for Outside Operators." The object of Mr. Walborn's paper was to strive to increase safety to station and other employees and to effect economy in operation as a result of safety measures. The rules and regulations given were general in character and need modification for local conditions. The author aimed to set forth some of the most important considerations, dwelling on some in detail but without attempting to frame an inflexible code to cover all conditions which obtain in the many power houses and substations throughout the country. Messrs. Brown and Metz suggested such rules and safety appliances for employees as will best promote safety, efficiency and economy.

Discussion

Messrs. W. Partridge of Clearfield, J. A. Metz of Hazleton, T. C. Walsh of Scranton, F. H. Stone of Pittsburgh, I. Walborn of Pottsville, C. W. Ward of Pittsburgh, T. Sproule of Philadelphia, E. F. McCabe of Titusville, S. W. Brown of Hazleton, T. G. Coghlan of New York and B. F. Day of Philadelphia joined in the discussion of both papers. Mr. Coghlan pointed out that many tests should be made daily and that a rule without a check was useless. By means of spaces in the boiler-room log book the engineer is enabled to see that the tests are made with regularity. Mr. Walborn told of the advantages gained by grounding the secondaries of transformers as a safety measure, and Mr. Day told of the difficulty of getting men to use the safety devices. A very general discussion ensued as to whether a company should furnish the lineman with belt and pliers or whether he should supply these himself. Some companies supply these and others do not.

ECONOMICAL OPERATION OF STEAM BOILERS

Mr. T. G. Coghlan of New York read a very interesting paper on the economical operation of steam boilers, stating that whereas thousands are spent on switchboard instruments and other equipment, the boiler room is left with the same old steam gage, and that not very accurate. Hand-fired boilers, he said, are not conducive to good results nor to the peace of mind of the operating manager. Aside from the losses due to opening doors, leaks, etc., the difficulty of securing and keeping the intelligent and skilful labor required makes hand firing out of the question so far as economical operation is concerned. Except in small installations, hand firing is no longer necessary, as stokers can be obtained for burning every kind of coal on the market. Mr. Coghlan described the E. B. Coxe traveling grate stoker for burning the smallest sizes of anthracite and told of the results obtained with it in practice. The central station, he said, must lead all others in economical operation and in the reduction of cost of manufacture so as to be in a position to sell energy cheaper than the user can manufacture it. Continuity of service, steadiness in operation, increased output, etc., he said, serve to attract the smaller class of business, but in big business, where the manufacturer can meet the service, cost is the vital element.

ELECTION OF OFFICERS

At the closing session on the morning of Sept. 18 the nominating committee reported on the following ticket which was unanimously elected: President, Mr. Duncan T. Campbell, Scranton Electric Company; vice-president, Mr. Walter E. Long, Philadelphia Electric Company; secretary-treasurer, Mr. S. C. Pohe, Columbia Power, Light & Railways Company of Bloomsburg; executive committee to serve two years, Messrs. E. B. Greene, Penn Central Light & Power Company of Altoona; E. H. Davis, Lycoming Edison Company of Williamsport, and H. N. Müller, Duquesne Light Company of Pittsburgh. Mr. W. C. Anderson, Luzerne County Gas & Electric Company of Kingston, was elected on this committee to serve one year.

Mr. Duncan T. Campbell, the newly elected president of the Pennsylvania Electric Association, has had quite an extended experience in the central-station business and possesses a host of friends in various sections of the country. Born in Glasgow, Scotland, Dec. 7, 1875, he came to the United States when about twenty-one years old and went West. There, in 1900, he entered the employ of the Denver (Col.) Gas & Electric Light Company as a solicitor in the new-business department. Thoroughly versed in the art, he left Denver in 1906 to take charge of the new-business department at Grand Rapids, Mich., going to Scranton, Pa., one year later as new-business manager of the Scranton Electric Company. In 1910 he was appointed general manager, and early this year he was elected a vice-president of the company. For the past five years Mr. Campbell has been active on the different committees of the Pennsylvania Electric Association, serving on the executive committee of the association for the past two years. Mr. Campbell is a member of the National Electric Light Association, the Illuminating Engineering Society, the Engineers' Society of Northeastern Pennsylvania and the Society for Electrical Development, in addition to numerous fraternal societies.

PRESIDENT-ELECT D. T. CAMPBELL

OPPOSITION TO USE OF POLES WITH BELL COMPANIES

The report of the public utility interconstruction committee dealt at length with the joint use of poles with telephone companies and with overhead-line construction at railroad crossings. The committee, of which Mr. E. H. Davis of Williamsport is chairman, was continued, and at the final session the following resolution was unanimously adopted as representing the attitude of the Pennsylvania Electric Association on the question at issue: "Whereas, the report of the committee on public utility interconstruction advises that the standard form of joint pole use agreement proposed by the Bell interests is not acceptable: Resolved, that while appreciating the desirability of the association co-operating with the telephone interests in a friendly spirit to secure a fair and proper mutual working agreement, and believing that future conferences conducted as above should be productive of satisfactory results, the association unanimously support the position of the committee and recommend that our members do not sign the agreement above referred to in its present form."

During the closing session the association also passed a resolution indorsing the purpose of the Society for Electrical Development.

Convention of New England Section, N. E. L. A.

The fifth annual convention of the New England Section of the National Electric Light Association was held at Burlington, Vt., Sept. 17 to 19, inclusive, headquarters being maintained at the Hotel Vermont. Four hundred members and guests, including forty ladies, registered, and the gathering, despite lowering skies, was one of the most successful in the history of the organization. The largest party in attendance left Boston on a special train of eight cars on the morning of Sept. 17. Many made the trip to and from the convention city by automobile, and a triumph in long-distance touring into virgin territory was scored by a Bailey electric roadster which made the trip of 258 miles from Boston over hilly and unknown roads at an average speed of 19 miles per hour.

Four business sessions were held, abstracts of the papers and discussions being given below. On account of the large attendance it was necessary to hold the business meetings at the Fifth Regiment Armory.

At the opening session President A. F. Townsend addressed the convention upon the activities of the national body, which now has 12,500 members. He referred to the striking address of Mr. Frank A. Vanderlip at the recent Association Island meeting as instancing the enormous growth and possibilities of the industry, touching upon the plans of the New England Section for bi-monthly "Get-Together" meetings this winter, and urged the addition of new members. The secretary's report showed that the present membership is 869, 96 new members having been added since Jan. 1.

Secretary T. C. Martin of the national organization addressed the convention at the first meeting upon the value of membership in the association to the small company. He pointed out that such a company receives far more than the cost of its participation and outlined the practical value of the Question Box, emphasizing the "return-mail" service given every inquirer when possible and the promptness which is constantly sought in obtaining answers to problems submitted by the member companies. He sketched the possibilities of the industry from the point of view of per capita earnings, which are rising in some instances to $15 or $20, with no end in sight.

"Problems of Central-Station Managers in Small Towns"

Mr. A. B. Marsden, Manchester (Vt.) Light & Power Company, in his paper on the above subject, emphasized the large numerical proportion of small central stations in towns of less than 5000 inhabitants and discussed the difficulties of the individual manager in such properties through multiplied duties. He urged the consideration by the section of more papers of practical interest to the "little fellow," who is immersed in details that often seem petty, but which must be cared for properly to insure success. In humorous vein the author described the daily round of duties of the small plant manager, who is "William the superintendent" one hour, dressed for office and street functions, and "Bill the electrician" the next, struggling with a wiring installation in overalls and jumper.

Discussion

The paper was discussed at length by Messrs. T. C. Martin, New York; Wilfred Smith, Woodstock, Vt.; Eugene Carpenter, Oak Bluffs, Mass.; H. R. Wilbur, Franklin, Mass.; W. P. Schwabe, Windsor Locks, Conn.; W. D. Jennings, New Haven, Conn., and A. L. Pierce, Wallingford, Conn. Mr. Smith made the suggestion that by the employment of blanks in connection with Question Box work the smaller companies could utilize the opportunities of this branch of the association's activities to better advantage. Mr. Carpenter pointed out that a paper which would interest a solicitor in a medium or large company should also interest the manager of a small plant, He also advocated raising new capital for extensions instead of trying to pay for them out of earnings. With open and frank statements of plans the money for an extension costing, say, $500 can readily be raised in many cases locally and the interest of the citizens sustained by the opportunity to share in the profits of the company.

Answering an inquiry by Mr. H. A. Sawyer, Amesbury, Mass., Mr. Carpenter said that in his properties each superintendent has a Ford runabout equipped with a 1200-lb. trailer having roller bearings, the combination being utilized in taking the line gang and its tools to each job in the morning, after which the superintendent uncouples the trailer, which is left with the men as an outdoor shop. He then visits customers in trouble or needing the company's attention, and returns at noon to take the men home for dinner, again attaching the trailer. The program is repeated in the afternoon, and the combination equipment, loaded, will make a speed of 15 miles per hour on the road. The cost of operating one of these cars since November, 1911, over 30,000 miles has averaged 5 cents per mile, including gasoline, oil, repairs and sinking fund on the car. Other speakers emphasized the importance of having troublemen available in small companies and urged the education of customers in replacing fuses.

"Principles Governing Central Stations in Line Extensions"

Under the above title, Mr. Alexander Macomber, electrical engineer of C. H. Tenney & Company, Boston, Mass., presented data from eighty New England central stations in connection with line extensions at first unprofitable. In fifty-eight cases the extensions are made with the assistance of the customer, in fourteen cases as a matter of policy or in hope that ultimate profits will result, and in eight cases such extensions are not considered by the companies. Twenty-six companies require payment for the whole or a part of the first cost. In case of part payment the amount is usually that proportion of the investment which will make the whole proposition feasible. Twelve of these twenty-six companies rebate this payment on the customer's part at a later time, the rebate taking the form of a lump sum, a percentage of the gross earnings of the extension, or a fixed percentage of the customer's monthly bill. Twenty-three companies favor obliging the customer to give only a guarantee of income. Fifteen of the twenty-three base this return on a percentage of the construction cost, while eight ask for interest and depreciation. The percentage guarantee varies from 10 to 50 per cent, the average number settling on 20 to 25 per cent. It is often required that this guarantee cover two to five years or more, in several cases the guarantee ceasing when a definite return is reached. Ten companies take no chances and require the customer to pay all or a part of the extension cost and to guarantee the income as a certain percentage of the cost, the latter being from 20 to 25 per cent as a rule. In conclusion, the author referred to decisions of the Ohio, Wisconsin and Maryland public service commissions bearing upon the problem of extensions.

Discussion

Mr. D. S. Boyden, Boston Edison company, said that it is poor practice to allow the prospective customer to pay for any proportion of the construction cost on highways. The simplest policy is to require an agreement insuring carrying charges on the investment and to oblige all subsequent customers to join in the obligations to the credit of the originator until such time as the company's interests are satisfied. Arrangements may be made for one or more years and for an amount equal to that required to discharge the obligations during the life of the agreement. Mr. R. D. Coombs, New York, favored private rights-of-way for extensions, particularly if commissions are to specify what detailed construction is to be installed upon highways. He considered this detailed supervision as beyond the scope of proper regulation. Mr. C. R. Hayes,

Fitchburg, Mass., cited the usefulness of joint pole-line utilization by central stations and telephone companies in districts offering little early revenue for the former, this being a good method of cutting down investment charges. He favored a liberal policy in constructing extensions. Mr. W. P. Schwabe, Windsor Locks, Conn., cited a case where a guarantee of only $2 per month was asked on an extension costing $250 upon estimates, and yet the prospective customer attempted to carry the matter to the state commission. The matter never got beyond the local selectmen, who recognized the justice of the proposed charge and refused to appeal to the state board. President A. F. Townsend said that he considered an extension of reasonable cost one whose investment would be equaled by the income in two or three years' time. An extension of six to ten poles would not be considered unreasonable in most cases in his practice. At Woonsocket, R. I., any extension cost up to $500 is met without hesitation by his company. Mr. E. F. Lawton, Hartford, Conn., said that the Hartford Electric Light Company will extend its lines without extra charge into any rural community which will contract for street lighting. Mr. Boyden said that the Boston Edison company will meet any extension or investment cost for a customer so long as it does not exceed $75, exclusive of meter and transformer expenses. Messrs. L. J. Chase, Concord, N. H., and A. L. Pierce, Wallingford, Conn., also spoke briefly.

"SOME PHASES OF ELECTRIC APPLIANCE MERCHANDISING"

Mr. W. G. Stetson, superintendent of appliance sales, Boston Edison company, presented a paper on the above subject which emphasized the need of adopting the principles of sound merchandising in marketing electrical conveniences. The sale of appliances should never be relegated to one side. These devices should be retailed according to the best modern business methods, without a colorless explanation and exhibit by the salesman which is described by the average central station as "preserving neutrality." All such apparatus is not equally good; the central-station man knows it, but in attempting to "keep friends" with all the manufacturers in the world, he is trying to carry water on both shoulders and the back of the neck at the same time. The appliance that is absolutely right is going to sell in every city in the United States. Appliances should be sold at a profit, like every other form of merchandise, and kept in service by intelligent follow-up methods. Some of the money which is being spent for the electrical education of the public should be used in the practical education of the trade.

Discussion

The paper was discussed by Messrs. E. M. Addis, Brattleboro, Vt.; R. P. Ingalls, Cambridge, Mass.; E. L. Cooley, Boston; J. T. Shannon, Waterbury, Conn.; C. B. Burleigh, Boston; A. F. Townsend, Woonsocket, R. I., and L. D. Gibbs, Boston. Mr. Addis took issue with the author regarding neutrality, contending that the central station should not express preferences when exhibiting competitive appliances. Neutrality has no attractions in Mr. Burleigh's opinion, his point being that the best apparatus will be demonstrated by use in the long run, and that nothing permanent can be gained by favoring all designs and makes alike. He criticised the use of the term "current-consuming devices" as one liable to scare off the public from the cost point of view, and favored the terms "electrical conveniences" and "current-utilizing devices." Mr. Townsend said that his company makes a free test of motor clearances, oiling conditions, etc., at intervals for the benefit of its customers. The desirability of having the families of central-station men become advocates of electrical service were touched upon by Mr. Gibbs, who said that every central-station employee should be provided with electricity in his home, even if the cost of installation had to be met by the company.

"VALUE OF THE ELECTRIC VEHICLE TO THE CENTRAL STATION"

Messrs. W. H. Snow and David W. Beaman, of the New Bedford (Mass.) Gas & Edison Light Company, presented a paper reviewing the well-known favorable load characteristics of electric-vehicle battery charging and calling attention to the increase in New England registrations as printed in the Sept. 20 issue of this paper. Figures were also given of the increase in machines used in many of the cities of the country in the past year. At New Bedford, Mass., 100 per cent more electric vehicles are in use; at Springfield, Mass., and Worcester, Mass., the growth has been at the same pace, and even in Hartford, Conn., a successful electric-vehicle town of established reputation, the increase has been 75 per cent. In New York City there are now 498 electric pleasure cars and 1700 commercial electric vehicles in service; in Chicago 2200 pleasure cars and 630 commercial machines; at Washington, D. C., 654 pleasure cars and 255 commercial vehicles; in Greater Boston 282 passenger cars and 261 commercial machines, and in Denver, Col., 850 passenger and thirty-seven commercial vehicles. A valuable portion of the paper consisted of testimonials of nearly forty concerns using electric vehicles in manufacturing, central-station, meat-packing, teaming, baking, furniture store and other services. The company is building a 65-ft. by 100-ft. garage in the heart of New Bedford which will house thirty machines and has found that even under conditions of heavy snow the electric truck will handle the required service far better than the horse.

Discussion

Messrs. R. W. Rollins, Worcester, Mass.; F. H. Smith, Worcester, Mass.; W. M. Thayer, Hartford, Conn.; J. A. Hunnewell, Lowell, Mass.; H. H. Skinner, Providence, R. I.; Welles E. Holmes, Cambridge, Mass.; J. T. Day, Malden, Mass., and Messrs. E. S. Mansfield, J. S. Codman, E. W. M. Bailey and Day Baker, Boston, commented upon the electric-vehicle situation. The point was made that the electric truck must be run close to its mileage capacities in order to secure its full economy. Under these conditions the saving in labor cost in carrying linemen and other construction forces rapidly about a system is very striking. At Lowell, Mass., this saving has largely offset the cost of operating the trucks. Mr. Hunnewell made the point that central stations should do their utmost to encourage the use of electric trucks in industrial service even in cases where the batteries are likely to be charged from mill plants.

Mr. Holmes described the electric-vehicle equipment of the Cambridge central station, which is characterized by bodies built according to the company's own designs, recently described in this journal. The Malden Electric Company now has six electric machines in service, four of which are run over eighteen hours per day. One has run 18,000 miles in the past nine months. In Malden energy at the rate of 30,000 kw-hr. per year is sold to a coal company owning two trucks, the service being rendered after 6 o'clock p. m. The point was brought out that at Cambridge the company meters battery-charging energy on the direct-current side of the garage motor-generator set to give the garage owner the minimum rate without discrimination in favor of direct current.

"CO-OPERATION OF ALLIED ELECTRICAL INDUSTRIES"

A group of four papers was presented upon this topic—from the point of view of the manufacturer, by Mr. S. St. John Morgan, Westinghouse Electric & Manufacturing Company, Boston; of the jobber, by Mr. W. J. Keenan, vice-president Pettingell-Andrews Company, Boston; of the contractor, by Mr. J. G. Gilliland, New England Engineering Company, Waterbury, Conn.; of the central station, by Mr. Francis A. Gallagher, Jr., Narragansett Electric Light Company, Providence, R. I.

Mr. Morgan pointed out that meeting competitors in friendly intercourse helps all to pursue an aggressive campaign for business and that collective effort is necessary to carry forward the industry. Competition offered by gas and other sources of power, apathy, ignorance and popular prejudice render co-operation the more necessary. The motto of the industry should be "The public be told." Local dealers, contractors and central stations should supplement the national advertising campaigns of the manufacturers by local advertising. Architect, contractor and builder need to be educated to provide outlets far more plentifully in new buildings. The public should be educated to equal familiarity with electrical and automobile terms. Larger use can be made of the literature, data, moving pictures and lectures available from manufacturers.

Mr. Keenan emphasized the good work being done by the Society for Electrical Development and contended that central stations should not become the active competitors of supply dealers in the appliance sales fields, but that in cases where such work is undertaken the electric service company should not sell appliances at a price below a merchandising profit. He was of the opinion that the free distribution of lamps for less than regular prices is injurious. Apparatus sold below cost by central stations means that the rates are higher in order to come out whole. Central stations should set the standard for the quality of apparatus permitted on their circuits. The author described the work of his company in endeavoring to popularize electricity. Notable features are a house organ with a circulation of over 5000 copies monthly and well-equipped "fixture studios." In the past decade more thorough technical knowledge has been acquired by jobbing houses.

Mr. Gilliland explained the necessity of the jobber to the contractor and severely criticised irresponsible electrical contracting. He favored a universal license law and closer scrutiny by central stations of the wiring connected to their distributing systems. The average property owner has no idea of the risk of incompetent or dishonest wiring. Central stations should not engage in wiring and the rates for service by electric heating devices should be lowered in many municipalities.

Mr. Gallagher pointed out that the manufacturer should be willing to teach the consumer the limitations of apparatus and should follow it in use. He condemned wiring by "basket contractors" and contended that for the present it is necessary for the central station to retail appliances in order to give the public the desired service. Ultimately this part of the business will gladly be turned over to the local dealers by central stations.

Discussion

Mr. H. E. Page, Hartford, Conn., said that the effect of giving the contractor too much credit is to encourage cheap work. Mr. H. T. Sands, Boston, maintained that the central station should control the lamp situation. Free renewals of defective lamps has been a powerful factor in the development of the industry. Mr. C. B. Burleigh, Boston, pointed out the benefit to the architect from increased commissions on a large number of outlets. Others who spoke briefly were Messrs. J. J. Myer, Boston; R. W. Rollins, Worcester, Mass.; Almon Foster, Boston; Charles Howes, Boston, and Eugene Carpenter, Oak Bluffs, Mass.

"Relation of the Central Station to Its Customers"

Mr. J. T. Shannon, United Electric Light & Water Company, Waterbury, Conn., urged the training of central-station employees to greater commercial efficiency and pointed out some of the difficulties resulting from indifferent, irresponsible or "smart" employees. He commented upon the importance of neatly dressed meter readers and courteous telephone operators and office assistants, and outlined the benefits of welfare work. A standard prize offer for suggestions resulting in service improvements is an excellent thing. In one case where a five-dollar prize was given to the employee not in the new-business department who furnished leads developing the most new business 100 new customers resulted. Positive following of complaints and checking them by telephonic inquiries are good methods of cultivating the public's appreciation.

Discussion

Mr. H. T. Sands, Boston, emphasized the importance of small things in dealing with customers. Adjustments of meter bills should be made only to satisfy the customer and not because of its being his due. If this is made plain, most customers will refuse to take the money. Rigid rules were not favored in dealing with the public. Eighteen dollars a week is not too much to pay for a good meter reader. Mr. C. H. Ingalls, Boston, stated that all inquiries by customers of meter readers and inspectors which cannot be immediately answered are referred to the proper department for final attention. Mr. F. H. Smith, Worcester, Mass., advocated an open-type office in which the public can come into immediate contact with the officers of the company. Mr. H. W. Moses described the work of the Boston Edison Welfare Bureau, which has noticeably raised the standard of employees during the past few months.

"Socket Voltage Versus Lamp Voltage"

Mr. Henry Schroeder, General Electric Company, Harrison, N. J., presented a paper urging that tungsten lamps be operated at their rated voltage. For every extra volt on the circuit 1.5 per cent extra central-station revenue can be obtained. At a 10-cent energy rate 100-watt tungsten lamps would be most economically operated at 6 volts above their rating, even when the lamps are paid for at list prices, and the frequency of renewals would be about the same as with carbon lamps allowed to depreciate to 80 per cent candle-power.

Nitrogen-Filled Lamp

Discussing recent improvements and researches, Mr. Schroeder said that the nitrogen-filled lamps thus far built have a minimum rating of 15 amp to 20 amp and a specific consumption of 0.5 watt per cp. For street lighting a constant-current transformer is used at each lamp to give the 20-amp current required, and lamps of 500 watts and 1000 watts rating represent the smallest sizes yet made. The 60-watt and 40-watt street lamps are being developed with nitrogen filling and 110-volt nitrogen-filled lamps are being made in sizes of from 750 watts to 1000 watts, the specific consumption ranging from 0.55 watt to 0.7 watt per cp, with a life test of 1500 hours.

Mr. F. W. Prinse, Hartford, Conn., defended the practice of running lamps at sub-normal voltage during the transition period in free lamp renewal practice, to keep the customers' bills down. Since the company adopted free renewals of 60-watt lamps in April last over three times as many of these in proportion to the 25-watt lamp have been installed as were put in by customers previous to the inauguration of free renewals.

Mr. S. R. Keyes, Boston, stated that he recently had operated a 6.6-amp street lamp at 6.7 amp and obtained 1000 hours' life with only 10 per cent drop in candle-power.

Election of Officers

At the closing session the following officers were elected for the ensuing year: President, Mr. C. C. Wells, Middlebury (Vt.) Electric Company; vice-president, Mr. Louis D. Gibbs, Edison Electric Illuminating Company, Boston, Mass.; treasurer, Mr. R. W. Rollins, Worcester (Mass.) Electric Light Company; executive committee, Messrs. Harry B. Ivers, Portland, Me.; L. J. Chase, Concord, N. H.; A. B. Marsden, Manchester, Vt.; E. P. Rowell, Plymouth, Mass.; E. A. Barrows, Providence, R. I., and B. H. Gardner, Waterbury, Conn. Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass., is secretary of the New England Section.

Pacific Coast Convention of the A. I. E. E.

The Pacific Coast convention of the American Institute of Electrical Engineers was held at Vancouver, B. C., Sept. 9, 10 and 11, with a total registration of 160, about one-half of the delegates coming from out of town. Good attendance marked the technical sessions and lively discussions followed each paper. Besides the entertainment features provided for the interims between sessions, two whole days after the close of the convention were devoted to sight-seeing and inspection trips to nearby water-power plants.

At the opening session of Tuesday afternoon Alderman Brown welcomed the delegates to Vancouver. Mr. R. F. Hayward, chief engineer of the Western Canada Power Company, then introduced Mr. J. A. Lighthipe, Los Angeles, Cal., vice-president of the Institute, who served as chairman throughout the business sessions. The first paper, presented by Mr. V. H. Greisser, was entitled "Snow and Ice Loading on Transmission Lines," and was read in Mr. Greisser's absence by Mr. C. F. Uhden, chief engineer of the Washington Water Power Company, Spokane, Wash.

Effects of Ice Loading on Transmission Lines

In his paper Mr. Greisser described a series of tests made on an experimental transmission line to determine (1) the influence on the loaded span of the elasticity of the cable, (2) the effect of swing of insulators, (3) the effect of using strain insulators at frequent intervals, and (4) the combined effect of all of these conditions. Numerous short-circuit failures which occurred during the winter season on a line owned by the Washington Water Power Company were traced to unequal loading of the spans caused by sleet and ice falling off some spans while it still clung to others. To investigate this class of troubles the test line was built, consisting of five 750-ft. spans identical with the troublesome transmission line. The tests showed the desirability of a change from the vertical arrangement of the conductors. To accomplish this the middle cross-arm was lengthened. The great influence of the length of the insulator on the increased sag was emphasized, and it was urged that insulator designers endeavor to shorten suspension-type insulators used for high-voltage work. In conclusion, consideration was urged for tower spacings at shorter intervals, to secure reduced maintenance and greater reliability.

Discussion

In discussing Mr. Greisser's paper Mr. R. F. Hayward, Vancouver, B. C., said he looked for radical changes in insulator design in the near future. He spoke in favor of the rigidly supported pin type rather than the suspension insulator now in use. Chairman Lighthipe said that on a 75,000-volt line in southern California pin-type insulators have been in service for five years, but a large percentage of them have broken down under the high voltage, and a return to the suspension type is contemplated.

In the debate on difficulties caused by sag in line wires owing to unequal loadings, it was suggested that the conductors be strung in a horizontal plane. Mr. Hayward, however, held that the chief danger of excessive sag lies in the near approach of the wire to the ground caused by the swing of suspension insulators, and that no arrangement of wires will obviate this. Mr. T. R. Cornick, Petaluma, Cal., pointed out that trouble on a line using pin-type insulators can be more easily repaired than on one using suspension insulators. He also cited a transmission line in Mexico using pin-type insulators, which has been subjected to the most adverse snow and ice conditions without sag troubles. The trend of the remarks in the discussion indicated a general belief that spans are now being made too long. Prof. V. Karapetoff, Ithaca, N. Y., also spoke against the use of low safety factors in transmission-line construction, suggesting a factor of four for transmission work in general.

Mountain Railway Electrification

The paper by Mr. Allen H. Babcock, San Francisco, Cal., contrasted the merits of steam and electrical equipment for the Tehachapi division of the Southern Pacific Railroad. The two slopes to the summit of this division are 49.5 and 18.3 miles long respectively, with ruling grades of 2.4 per cent. A 2400-volt, third-rail system was assumed, using 100-ton electric locomotives for 500-ton freight-train units and 150-ton locomotives for passenger service. On the basis of present traffic it is shown that electrification of this division would not be justified from a financial viewpoint, whether energy were generated in a power house built by the company in the oil fields which lie 20 miles from the right-of-way or were purchased from some existing central station. Appended to the paper data were given on substation spacing, heating load, generating station, transmission line, block signals, shops and inspection shed, electric locomotives, steam locomotive credits, maintenance of way as affected by locomotives, locomotive repair, enginemen's wages, fuel, tunnel clearances and annual tonnage.

Discussion

In reviewing his paper Mr. Babcock commented on the general disappointment resulting from the decision against electrification reached by the company, but said he felt sure the results as set forth in the paper were correct. A strong argument against electrifying certain divisions was the resulting discarding of steam equipment. Again, electric motors can be operated only on electrified divisions, while steam locomotives could be taken to any part of the system in emergencies. Under favorable conditions on down grade a certain amount of power could be regenerated and returned to the system. But, of greater importance, the enormous sum paid yearly for broken wheels, axles and other equipment destroyed by mechanical braking methods could largely be saved by electric braking.

Mr. J. B. Fisken, Spokane, Wash., suggested that the decision of the Southern Pacific company might have been different if, at the outset of the investigations, a stretch of 300 or 400 miles had been considered, instead of 68 miles with heavy grades. The load-factor over the longer stretch would be higher, and the difference in operating cost might be such as to make the electrification of a mountain division feasible.

Gulf of Georgia Submarine Telephone Cable

The submarine telephone cable recently laid between Point Grey, just off Vancouver, and the city of Nanaimo, on Vancouver Island, was the subject of a paper prepared by Messrs. E. P. La Belle and L. P. Crim. The cable, which is 32.6 miles in length, is of the continuously loaded type and is the first of its kind to be laid in America. Data from factory tests were contrasted by the authors with results obtained after the cable had been laid. Throughout the operation of stringing the cable its conductors were in use either as circuits for communication with the land station or for testing to discover faults that might result from handling. The depth of water in the channel, 1300 ft., made it impossible to lay the cable without subjecting it to a high tensile strain, which was the reason for using a large amount of gutta-percha in its manufacture. Prior to the selection of the type of loading, careful study was made of the relative advantages of a continuously loaded and a coil-loaded cable for the special Georgia Gulf conditions. The paper was concluded with an enumeration of the principal arguments for each type of loading.

Substation in the Cœur d'Alene Mining District

In the paper by Mr. John B. Fisken, Spokane, Wash., a typical mine substation was described. This installation was one built by the Washington Water Power Company for supplying 2300-volt, three-phase service to the Bunker Hill and Sullivan mines and for lighting the mining towns of Kellogg and Gardner. The building has a frame of

structural steel, roofed and covered inside and out with corrugated, galvanized steel. This type of construction has been adopted in preference to brick on account of the ease with which the building may be taken down and reassembled as the development of the mine may require. The paper gave a detailed list of equipment, together with the total construction cost, the cost per kva, and the annual operating cost. The connected load of motors at the mine totals 3000 hp. Tables of distributed costs of electric-light and motor service for the average month were given, showing the outlay for this service for different mining operations.

Discussion

Referring to Mr. Fisken's paper, Mr. C. F. Terrell, Seattle, Wash., expressed his preference for self-cooled transformers over the water-cooled types in use. Although higher in first cost, the former afford greater simplicity and reliability. Mr. R. F. Hayward commented that automatic substations are more important in the West than in the East because of the former's higher labor costs. However, such stations must be very dependable, because to break even momentarily the circuit operating a mine concentrator would mean choking the machine and would necessitate its being cleaned out and started over again.

Professor Karapetoff mentioned trouble experienced with the blowing of fuses on a 60,000-volt circuit protected by copper wires about 16 ft. long incased in rubber tubes. There was no method of announcing the break to the nearest patrolman. After trying various complicated schemes, weights were attached to the wires so that when the fuse blew a circuit would be closed, ringing a bell. Mr. Fisken emphasized the fact that a bank of three single-phase transformers has six points of weakness in its entrance bushings, while the equivalent three-phase transformer has only three. He said, however, that the installation referred to had given satisfactory results for three years. Ten years ago, said Mr. Fisken, grounds were in use throughout the system, but operating experience has now led to the removal of all grounds except at the power plant, where "dead" grounds are used without resistance. The rate to mining companies in the Cœur d'Alene district is $3 per kva of maximum demand plus a charge of 0.5 cent per kw-hr. consumed. From these figures the discounts allowed, depending on the term of the contract, are as follows: Two years, 10 per cent; three years, 15 per cent; five years, 25 per cent.

Oil Circuit-Breakers for High Potentials

The paper prepared by Mr. K. C. Randall, Pittsburgh, Pa., and read in his absence by Mr. A. A. Miller, gave a brief outline of recent important developments in oil circuit-breakers. Ideal conditions require that the current should not re-establish itself after passing the first zero of current value following the opening of the contacts, and this emphasizes the necessity of high opening speed in a circuit-breaker. However, there is nothing to be gained by increasing breaker speed beyond 0.5 cycle, as the stored energy of the circuit may be assumed to appear as heat at the arc; hence if the arc holds only till the first zero current value has passed, the stored energy of the circuit will have been dissipated.

Breakers have been designed in which resistances were introduced to limit the current to a value readily ruptured, but, owing to inherent difficulties with this method, reactance has been successfully substituted for resistance. Such reactance breakers have two sets of contacts—the main set, which carries the normal current, and an auxiliary set, which carries the reduced current after the reactance has been introduced by the opening of the main contacts. Oscillograph records showing the rupture of a 12,000-volt circuit carrying 12,000 amp were included in the paper to illustrate the action of current waves on the opening of the contacts of a reactance breaker.

Discussion

In discussing Mr. Randall's paper, Mr. L. G. Robinson, Vancouver, B. C., suggested the possibility of designing a type of circuit-breaker in which several gaps might be interposed in series by the use of a light mechanism. He proposed that sixteen or twenty gaps be employed for high voltages, thus securing a very steep curve of potential distribution across the opening. The sum of the distances at the several gaps need not be so great as that required for a single gap.

Logging by Electricity

The paper on logging by electricity, presented by Mr. E. J. Barry and read in his absence by Mr. W. E. Herring, described the operation of the motor-driven timber-hauling and loading apparatus used in the Elk River district of Idaho. The author told briefly of the "sky-line" system by means of which all of the timber within a radius of 3000 ft. to 4000 ft. may be cleared without moving the haulage cutfit. With this method of clearing only one end of the log is dragged on the earth, so that less trouble is experienced at the mill from stones and gravel in the bark of the timber. The speed of haulage for the average log is approximately 1000 ft. per minute.

The electrical equipment for each outfit consists of a 150-hp, 550-volt, 60-cycle, three-phase induction motor operating at 600 r.p.m. The motor is of the totally inclosed type and is fitted with a solenoid brake. Energy is transmitted to these machines over 11,000-volt transmission lines ending in portable substations or transformer cars.

Tests have shown that the saving effected by electricity over steam is about 50 cents for each 1000 log-ft. This fact, together with decreased fire risk, elimination of need of water supply and increase in speed of hauling, make central-station service highly desirable for logging operations. An average of 10 kw-hr. is consumed for each 1000 ft. logged.

Entertainment Features

On Wednesday evening an audience of 200 listened to a piano recital by Professor Vladimir Karapetoff, of Cornell University, which was followed by a stereopticon lecture on the electrical-engineering features of the Panama-Pacific Exposition by Mr. A. H. Halloran, managing editor *Journal of Electricity, Power and Gas,* San Francisco, Cal.

At the banquet of Thursday evening Mr. R. F. Hayward acted as toastmaster, and addresses were made by Messrs. J. A. Lighthipe, F. L. Hutchinson, Ralph W. Pope, A. H. Halloran, V. Karapetoff, N. A. Bowers and G. R. Murphy. Besides the inspection trips and automobile rides about Vancouver, a special train on Friday conveyed the visitors to the Stave Falls water-power plant, and on Saturday launches transported them to the Lake Buntzen stations of the British Columbia Electric Railway Company. Spokane has been recommended as the meeting place for the 1914 Pacific Coast convention.

Third International Congress of Refrigeration

After the formal opening ceremonies in Washington on Sept. 15, the regular sessions of the third International Congress of Refrigeration were begun in the Hotel La Salle, Chicago, on Sept. 17. Meetings were continued until Sept. 24, when the closing sessions were held. The congress was divided into six sections. The first related to the scientific aspects of the subject, the second to refrigerating machinery and insulating materials, the third to refrigeration of foods, the fourth to refrigeration in the industrial arts, the fifth to refrigeration in transportation, and the sixth to questions relating to legislation and administration. The president of the International Congress of Refrigeration was Mr. André Le Bon, of Paris, former Minister of Commerce of France. The local president was Dr. Frank

W. Gunsaulus, president of the Armour Institute of Technology.

Dr. A. C. Humphreys, of New York, president of the Stevens Institute of Technology, was down on the program as president of the second section, but he was unable to be present at the opening session, and Mr. N. H. Hiller, president of the Carbondale Machine Company, Carbondale, Pa., vice-president of the section, occupied the chair. Four honorary presidents were elected. One of these, Prof. L. Marchis, of Paris, was present at the opening session and made a speech in French. The other honorary presidents of the second section were Messrs. Philip Porges, Austria; F. Schipper, Germany; A. W. Rjasantzeff, Russia, and Johan Gustaf Richert, Sweden. Mr. V. H. Green, engineer of the De La Vergne Machine Company, of New York City, was the secretary of the second section.

In the absence of President M. L. Holman, of St. Louis Vice-president R. H. Tait of the Tait-Nordmeyer Engineering Company, of St. Louis, presided at the opening session of the fourth section. Prof. E. L. Ohle, of Washington University, acted as secretary. The honorary presidents of this section were Mr. E. Engelmann, Austria; Prof. J. T. Lundbye, Denmark; Mr. Casimir Monteil, France; Mr. M. Hirsch, Germany, and Mr. E. G. Perrimond, Russia.

A large number of papers were presented for the consideration of the congress. The official languages were English, French, German, Italian and Spanish. All papers were printed in English, French or German. Interpreters were present to be utilized as needed.

The attendance at the congress was about 700, about 150 coming from foreign countries. This is the first international congress of refrigeration to be held in the United States, the first having been held in Paris in 1908 and the second in Vienna in 1910. A refrigeration exposition was held at the International Amphitheater, Chicago, in connection with the gathering.

Many industrial and sight-seeing excursions took place during the convention, as well as several luncheons and dinners. On Sept. 19, under the guidance of Mr. Theodore O. Vilter, nearly all the members of the congress visited Milwaukee. One of the places of interest visited in Chicago was the Fisk Street station of the Commonwealth Edison Company.

A number of kindred societies, like the American Society of Refrigerating Engineers, held meetings during the congress.

An interesting paper was read at one of the sessions of the second section by Mr. L. C. Nordmeyer, of St. Louis, on "The Comparative Installation and Operating Cost of a Combined Ice-Manufacturing and Cold-Storage Plant." The authors, Mr. R. H. Tait and Mr. Nordmeyer, compared the cost of energy for operating a straight steam compression plant, a compound condensing plant and an oil-engine plant with electrical auxiliaries. They found that the oil-engine installation tested worked out considerably cheaper.

In the discussion Mr. N. H. Hiller, of Carbondale, Pa., contended that Mr. Nordmeyer had failed to take into account the advantages of the exhaust-steam absorption method, which he thought compared favorably with any of the others in operating cost. Several other members spoke about the cost of fuel oil. Mr. Nordmeyer in his paper figured on a cost of 95 cents a barrel of 42 gal. It was pointed out, however, that the price of oil is now about $1.22 to $1.25 a barrel or, by the gallon, from 3.5 cents to 4 cents. One gentleman made the interesting statement that when the price of crude oil exceeds $1.10 a barrel it is thought to be more economical in the Southwest to use coal as fuel under the boilers of ice plants. In answer to an inquiry another delegate mentioned a plant in St. Louis where a gas engine is directly connected to an ammonia compressor.

CENTRAL-STATION ELECTRICAL ENERGY FOR ICE MAKING

The paper of the greatest practical electrical interest was that on "Artificial Ice Making and Refrigeration from the Standpoint of the Central Station." It was read by the author, Mr. C. H. Stevens, manager of the power engineering bureau of the Edison Electric Illuminating Company of Brooklyn, at the session of the fourth section on Sept. 20. Mr. Stevens set forth the advantages of central-station electrical energy in ice making. He said that the use of high-pressure multiple-effect evaporators in connection with distilled-water ice plants is an important step in making feasible the use of central-station energy in ice making. Further, the advent of the raw-water system has put the ice plant distinctly within the field of the central station. Data from three large plants using central-station energy in making ice gave the average energy consumption per ton of ice as 46.89 kw-hr.

In a brief discussion Mr. George H. Jones, of the Commonwealth Edison Company, made the point that the use of central-station energy enabled the ice maker to cut down the cost of cartage by locating his plant near the center of the area of delivery. The cost of delivering ice is a large item, and, where there is no fuel to be delivered, medium-size ice plants supplied with energy from the central station can be located at advantageous points to effect economy in delivery. Mr. Jones believes that 150,000 tons of ice will be made electrically in Chicago this year. Mr. R. H. Tait, of St. Louis, a refrigerating engineer, remarked that unquestionably if the central station could sell energy to the ice man cheaper than he could produce it, the isolated power plant would be superseded in ice making. Mr. Dohrmann, an ice manufacturer of Brooklyn, said that boiler-room troubles are not uncommon in ice plants. These would be done away with by the purchase of electrical energy. This speaker has great faith in the future of central-station energy for ice plants. Mr. McGinnis, of the Lincoln Ice Company, of Chicago, one of the customers of the Commonwealth Edison Company, gave purchased electricity a hearty indorsement. He operates an electric raw-water ice plant and made 27,000 tons last year and expects to make 35,000 tons this year. He has no difficulty in competing with distilled-water ice and believes that, on the average, raw-water ice is better. It is worth a good deal, he said, to have no cares of power-plant operation. He is an ice-maker, he said, not an energy producer, and is content to remain so. In answer to a question Mr. McGinnis said that he paid 1 cent per kw-hr. for his energy. Mr. Stevens' paper, it may be added, showed that Mr. McGinnis' company's consumption for the year ended Feb. 28, 1913, was 1,455,012 kw-hr.

At the same session Mr. Peter Neff, of Canton, Ohio, president of the American Society of Refrigerating Engineers, read a paper on "The Manufacture of Distilled-Water Ice," in which he showed that it costs more to make ice by this process than is commonly supposed.

Public Service Commission News

WEST VIRGINIA COMMISSION

Action on the applications of different hydroelectric companies for permits has been postponed by the Public Service Commission of West Virginia until Oct. 14. Various coal, timber and railroad interests contend that the hydroelectric developments would interfere with their properties. After the receipt of the protest from these companies against the hydroelectric projects, the companies which seek permission to erect dams and develop water-power had an opportunity to file amended applications. The Tax Commission of West Virginia contended that the companies should pay a license tax before permits were granted, but the Public Service Commission ruled

that license fees should not be paid until the permits had been issued.

Wisconsin Commission

The investigation of the costs of street lighting in Milwaukee, made by the Railroad Commission of Wisconsin at the request of the lighting committee of the City Council of Milwaukee, has been mentioned in these columns. The commission found that the city would get its service cheaper if it made a contract with the privately owned utility than if it built a municipal plant for the purpose.

The general conclusions of the commission were stated briefly in the report as follows:

"It is believed that the adoption of a combined system of 4-amp series luminous arcs and tungsten lamps, substantially as proposed, would result in satisfactory illumination as measured by present-day standards.

"What would it cost the city to build and operate a lighting system to supply this service?

"The commission's conservative estimate of the investment is $1,493,258, and of the annual operating expenses $273,053. Assuming that two tungstens are equivalent to one arc lamp, as far as cost is concerned, the average cost of operation is found to be $75.11 per lamp.

"In arriving at the operating cost for service rendered by the privately owned utility, the estimated investment was divided between lamps on overhead and underground circuits. The difference in the cost as shown below is due to the difference in the fixed charges for the different investments: 4-amp magnetite arcs on overhead circuits cost per year $54.91; 80-cp series tungstens on overhead circuits cost per year $26.82; 4-amp magnetite arcs on underground circuits cost per year $75.69; 80-cp series tungstens on underground circuits cost per year $39.37.

"As the computed costs include nothing for deductions because of unavoidable outage and as the interest charges were determined on a very close basis, the suggested rates are placed at a slightly higher figure than the costs shown above. The following summary shows what the total charge to the city would be at these rates: Arcs on overhead circuits, 2227 at $55, $122,485; tungstens on overhead circuits, 298 at $27, $8,046; arcs on underground circuits, 1233 at $76, $93,709; tungstens on underground circuits, 51 at $40, $2,040; total, 3809, $226,280.

"The average rate, assuming two tungstens equivalent to one arc lamp, would be $62.25. It appears that the excess of cost of municipal operation over private operation is about $46,873 per year.

"The contract should specify the terms and conditions for the following matters: Period of contract, kind and initial number of lamps, burning schedule, rates for initial lamps of each kind, deduction for outages, rates for additional lamps during early life of contract, rates for additional lamps ordered during last three years of contract period, location of additional lamps, compensation for relocation of lamps, and substitution of different type of lamps.

"What is the cost of electric street lighting now furnished to the city of Milwaukee?

"The total annual operating expenses and unit costs per lamp per year as determined by the commission's apportionment of the operating expenses are shown below on several interest bases: Interest at 7.5 per cent, $175,104, or $75.50 per lamp; interest at 7 per cent, $171,104, or $73.77 per lamp; interest at 6.5 per cent, $167,104, or $72.04 per lamp.

"What would be the costs if 4-amp luminous arcs were substituted for all arc lamps on the system?

"The total estimated annual operating expenses and the unit cost per lamp per year on this basis are as follows for similar rates of interest: Interest at 7.5 per cent, $163,767, or $70.65 per lamp; interest at 7 per cent, $159,872. or $68.97 per lamp; interest at 6.5 per cent, $155,654, or $67.15 per lamp."

Current News and Notes

Annual Meeting of the Iowa Association.—The Iowa Street and Interurban Railway Association will hold its next annual meeting on April 23, 24 and 25, 1914. Mr. H. E. Weeks, of Davenport, Ia., is secretary and treasurer of the association.

* * *

Electrical Inspectors' Annual Meeting.—The ninth annual meeting of the Western Association of Electrical Inspectors will take place in Cincinnati from Jan. 27 to 29, 1914. Mr. William B. Hubbell, First National Bank Building, Cincinnati, Ohio, is the committee of arrangements. Mr. William S. Boyd, 76 West Monroe Street, Chicago, is secretary and treasurer of the association.

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A Good Day's Work in Pulling Cable.—The *Canal Record* of Ancon, Canal Zone, reports that the force engaged in pulling in cable at the conduits at Miraflores locks established a record on July 25, when 7444 ft. of five-conductor cable and 10,000 ft. of eight-conductor cable was pulled into the ducts in the center wall of the upper lock. This is a total of 17,444 ft., or more than 3 miles of cable, in a day of eight hours.

* * *

St. Louis League of Electrical Interests.—The first meeting of the season of the St. Louis League of Electrical Interests was held at the City Club on Sept. 23. The meeting was turned over to the Jovians, who are in the middle of an active campaign to elect next year's Jupiter. Mr. W. N. Matthews, vice-president of the League of Electrical Interests, is a candidate, and the St. Louis Jovians are backing him enthusiastically.

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Steinmetz Lecture in Chicago.—Dr. C. P. Steinmetz, of Schenectady, N. Y., is scheduled to deliver his annual Chicago lecture at Fullerton Hall, Art Institute, on the evening of Oct. 29. The subject announced is "Stability and Instability in Electric Circuits." The lecture is to be given at a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers.

* * *

Electric Vehicles Economical Street Cleaners.—The street-cleaning department of Berlin, Germany, employs eighteen battery-driven sprinkling and scrubbing machines, whose total daily operating and maintenance cost is $4.41 each. The daily cost of each of ten horse-drawn machines is $4.57. Each of the electrically driven machines cleans 55,496 sq. yd. in the average eight-hour day, while each horse-drawn machine cleans 44,013 sq. yd. The former therefore accomplish over 26 per cent more work at about 4 per cent less cost or, in other words, are about 30 per cent more economical.

* * *

Annual Meeting of the Empire State Association.—The annual meeting of the Empire State Gas & Electric Association will be held on Oct. 2 at the Engineering Societies Building, New York. President C. G. M. Thomas will review the work of the past year and offer suggestions for the coming year. Reports of other officers and committees will be made, and the plans for the advertising campaigns of the Society for Electrical Development and of the National Commercial Gas Association will be explained and discussed. Addresses will be made by Mr. Martin S. Decker, chairman of the Public Service Commission of the Second District, New York, and by Mr. M. R. Maltbie, commissioner of the First District. Accident prevention and fire prevention will be discussed at the afternoon session. Mr. C. H. B. Chapin, 29 West Thirty-ninth Street, New York, is secretary of the association.

Commonwealth Edison System Operating Features

Sharing by schedule peak loads of 233,000 kw between three great Chicago turbine stations—Work of the load dispatcher in supervision and control

THE generating equipment of the Commonwealth Edison Company is comprised in three power plants, all of which have been fully described in previous issues of the *Electrical World*. The down-town and southern parts of Chicago are served from the Fisk Street and Quarry Street stations, which have a combined rating of about 200,000 kw. The new Northwest station, which has just completed a year of very successful operation, supplies a rapidly growing demand in the district covered by its name. As will be shown later in the present article, the capacity of all these plants was fully taxed last winter. Extensions are now under way to provide for the future, a 25,000-kw Parsons unit having just been completed in England. This great turbine will soon be erected and before long still larger horizontal Curtis turbines, now being constructed at Schenectady, N. Y., will be ready for installation.

The load on the Commonwealth Edison stations is made up of the demands of the surface and elevated railways and of the company's individual lighting and industrial motor-service consumers. At present the railway component predominates. The annual peak load occurs when the railway, motor and lighting peaks are superimposed, between the middle of December and the middle of January. From this period to midsummer a gradual decline takes place, the load at the low point being about 65 per cent of the winter peak. During the past winter it reached a maximum value of 232,950 kw, and it has since fallen to a minimum of about 160,000 kw in July. From the first of August it has again been rising gradually, but beginning shortly it will rise more rapidly to a winter maximum estimated at 265,000 kw.

The growth in the company's load during the past ten years has been remarkable, having on the average amounted to more than 25 per cent per annum. Judging from the rate at which new contracts are now being signed, this growth will be maintained for some time to come. Only recently the company contracted for 4500 kw of industrial service to a single customer and more large contracts of this kind are in prospect. The railway load also continues to increase rapidly.

Composite Load Curves

In studying the nature of the load curves the company has for a number of years put them into the form shown herewith, in which form they are known as " composite load curves." They are plotted between the different values of the load and the duration of these loads. The curves

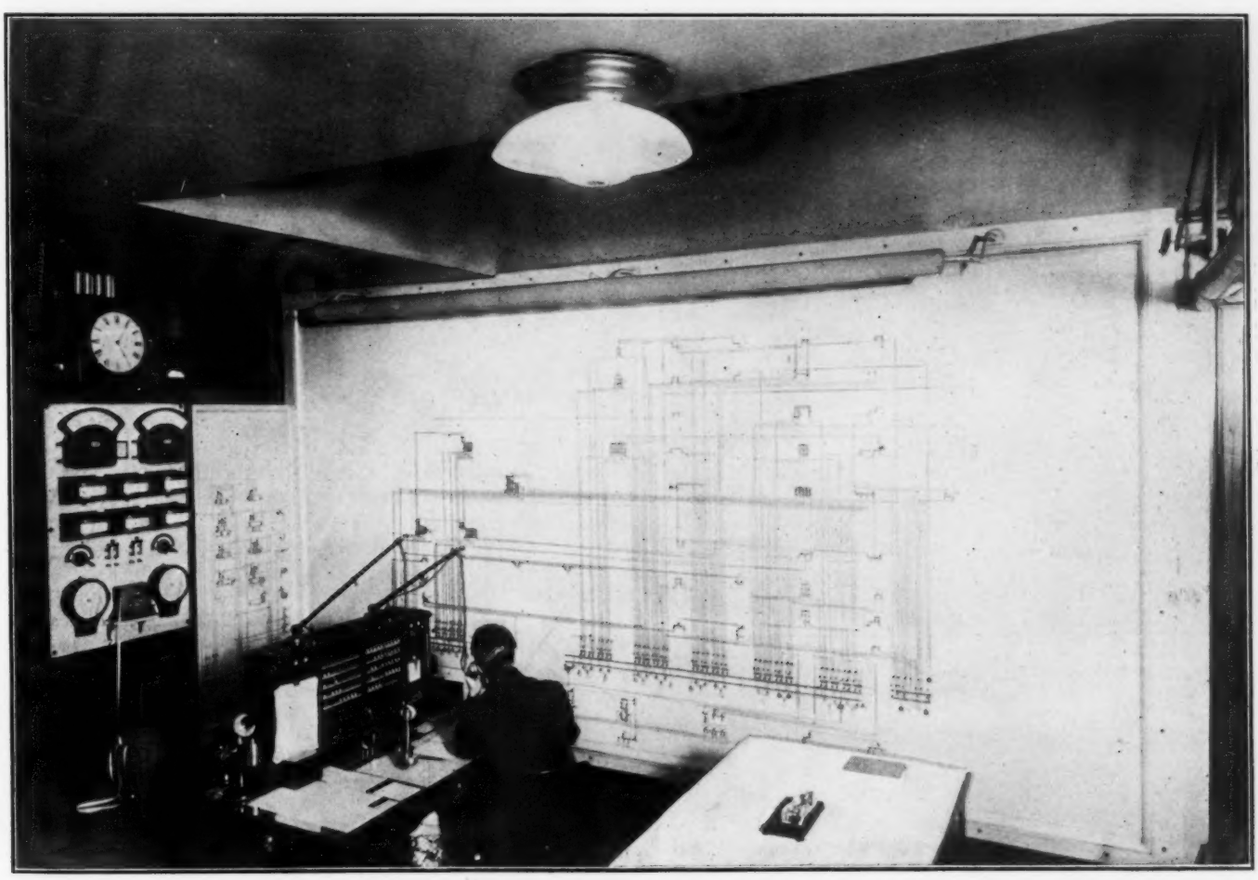


FIG. 1—THE "NERVE CENTER OF THE SYSTEM"—LOAD DISPATCHER'S OFFICE, COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

show that the total load exceeds three-fourths of its maximum value for but 150 hours during the year, while the energy output above three-fourths load is but 0.3 per cent of the total. This 150-hour peak is, therefore, a very expensive load as to produce it requires an investment of one-fourth the total.

During the last four years the load has exceeded one-

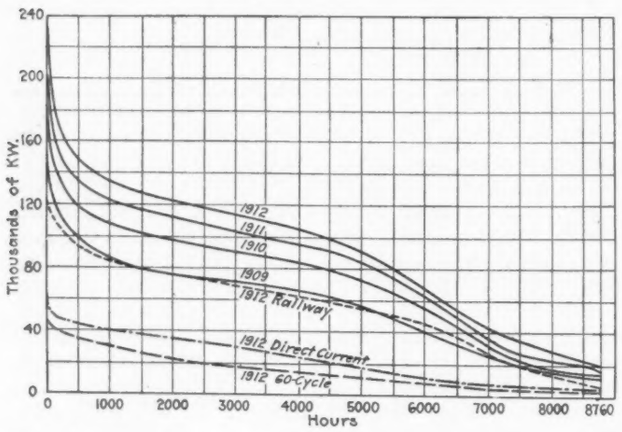


FIG. 2—COMPOSITE LOAD CURVES, COMMONWEALTH EDISON SYSTEM

half the maximum for somewhat less than 200 hours each year and one-quarter of the maximum for about 5300 hours. The curves for four years past show that these figures do not vary much from year to year. Undoubtedly, as the yearly load-factor continues to improve, the duration of the heavier load will increase, but as the load is now quite diversified the change will not be very great.

The total system load is made up of several distinct classes of service as already suggested. The lighting and industrial motor load is, in turn, of two varieties, direct-current service and 60-cycle alternating-current service. Each has its distinctive characteristics, the difference between the direct-current and 60-cycle loads being due largely to the nature of the districts which they supply. The bulk of the direct-current load is confined to the down-town districts, where very little residential lighting is

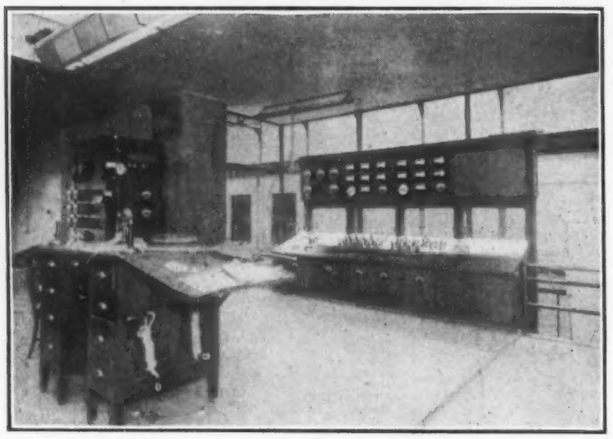


FIG. 3—BENCHBOARD AND OPERATING GALLERY, NORTHWEST STATION

encountered and where, consequently, the load largely disappears after office hours. In the outlying districts, where alternating-current is furnished, the chief part of the lighting load comes on after the motor load has become negligible. As a result the 60-cycle load has a broader peak. This is clearly shown in the curve, where the composite values for the railway, direct-current and 60-cycle loads are given for last year. The 60-cycle load exceeded three-fourths of the maximum for 550 hours, while the direct-current load did the same for only 160 hours. It is interesting to note that the railway load curve conforms very closely to the characteristics of the direct-current and 60-cycle loads. Its peak is due to the increased traffic mornings and evenings, as well as to the car-heating load in winter. The peaks of these three different kinds of service are fortunately not coincident and, therefore, their sum does not give the total system peak, the diversity factor for different classes of service making itself here clearly evident.

Division of Load Among Generating Stations

The load on the system is normally divided among the three generating stations, each of which operates under a predetermined schedule arranged in the load dispatcher's office. The only deviations allowed from this schedule are those due to trouble in one generating station or another, necessitating special action on the load dispatcher's part. As all three stations are interconnected through tie-lines, a schedule of this kind is the most satisfactory manner of regulating the output of each station.

For example, the Quarry Street station feeds normally about 2000 kw into Fisk Street, while another 2000 kw is carried by the Northwest station, which ties in with Fisk

FIG. 4—OPERATING GALLERY IN SWITCH HOUSE, QUARRY STREET STATION

Street by tie-lines in the middle of which the substation load is tapped off. In addition, the Northwest station feeds other substations over direct lines. Between the hours of 5 and 6:30 p. m. only the Northwest station, according to schedule, feeds 4000 kw into Fisk Street. The result of this plan of operation is that all stations have similar load curves and likewise proportional outputs. In case of trouble at one station or another, communication with the load dispatcher results in the issuance of instructions to the other stations to depart from schedule and to carry such additional load as conditions may require.

Paralleling Through Reactances

At the present time the entire system is operated as one unit, all parts being run in parallel. The paralleling of its different parts, however, is done over system reactors having a total reactive drop of 20 per cent at their rated full load, which is 10,000 kw. These reactors are located at the Fisk Street station. Normally the Fisk Street and Quarry Street stations are operated as an open ring, with the Quarry Street plant in the center and the halves of Fisk Street at each end. The Northwest station is tied in with one of the two parts of Fisk Street but without system reactors. However, when the number of units in operation at Fisk Street is seven or less, the open ring is closed

at Fisk Street, it being separated again when the number of units exceeds seven.

The presence of the system reactance requires the preserving of the identity of each section, as with any large amount of power flowing over the tie-lines a considerable phase displacement results across the reactance. This phase displacement exists also between lines from these different sections, and if such two lines from different sections were closed together in a substation, the system reactance would thereby, in effect, become short-circuited through them. This would result in an extremely heavy cross-circuit between the two sections and the opening of the two lines would be the probable result.

For the above reason differently colored plugs are used to indicate on the load dispatcher's board the extent of each section, and red plugs are used wherever the lines from any two sections may be tied together. If at any time it becomes necessary to tie any two such tie-lines together, the load dispatcher must first adjust load conditions over the corresponding system reactance.

If it is necessary to tie together two lines from the two sections of Fisk Street, the load dispatcher orders the load on both of the Fisk-Quarry tie-lines reduced to zero, or else orders the load equalized in the same direction. If switching is necessary between a line from Quarry Street and a line from either section of Fisk Street, the load on the

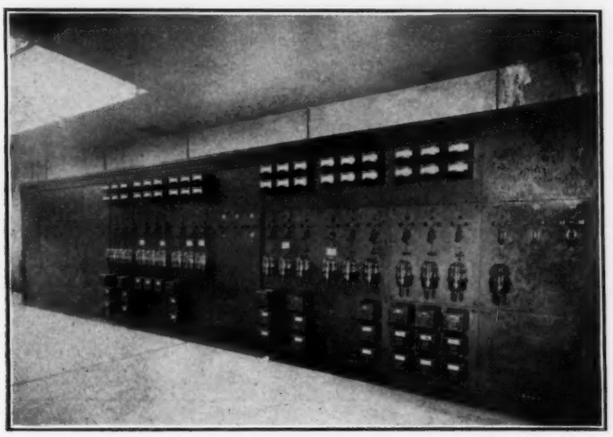


FIG. 5—FRONT OF FEEDER SWITCHBOARD, NORTHWEST STATION

tie-line connecting the Fisk Street section in question with Quarry Street must first be reduced to zero. After the necessary switching has been performed, schedule operation of the different generating stations is again resumed on order from the load dispatcher.

SWITCHING OPERATIONS

Ordinarily the bulk of the high-tension switching is done during the night hours, as at this time the routine high-tension repair work and all other work requiring the removal of important lines from service is in progress. Nevertheless, on a large system like this, work on the high-tension system is almost continually in progress at one point or another, and this, combined with the regular switching during the day required to keep within comfortable limits the temperature on certain heavily loaded lines, furnishes occasion for a considerable amount of switching during the day.

An interesting "kink" resorted to is the "line load-check," which the load dispatcher employs while giving orders for switching operations. If switching is to be done between any two lines, the load dispatcher first obtains a reading of the instruments of these lines. He then gives the order to tie the lines in question together. Except in very rare cases a change in load is observable after the two lines have been tied together, and this serves as a check to the load dispatcher that his order has been properly executed. He then separates the two lines at some other point, thereby completing the desired transfer of load from one line to another. If a load change on the two lines in question is not observed, it is an indication that the two lines have not been tied together, owing perhaps to such conditions as clips being left out of lines or

FIGS. 6 AND 7—AUXILIARY SWITCHBOARD AND REAR OF FEEDER SWITCHBOARD, NORTHWEST STATION

similar causes which can then be readily discovered on a "check-up."

REPAIR OR INSPECTION ROUTINE

All apparatus in service is at all times under the direct control of the operating department, and to take any line or unit of any description out of service, there is required what is known as a "load dispatcher's permit." Application for such a permit is made out by the foreman in charge of the work to be done on a certain part of the system and is then forwarded to the starting engineer, who approves it and, in turn, forwards it to the load dispatcher's office after he has appointed a deputy. The load dispatcher then issues a permit for such hours as are most suitable for the performance of the work and returns it to the foreman

FIG. 8—OIL-SWITCH MECHANISM, NORTHWEST STATION

in charge. The latter, upon starting the work, presents his permit to the opertor in charge of the apparatus, who then consults the load dispatcher as to taking the apparatus in question out of service. The operator then disconnects the apparatus in accordance with the load dispatcher's orders. After applying proper safety devices for the protection of the men, he also attaches "hold cards," stat-

ing the time they were placed, the reason for cutting the line out of service, the name of the load dispatcher who ordered the cards placed, and the name of the foreman in charge of the work. Thereupon the foreman is permitted to proceed with the work.

After the work has been completed the foreman and

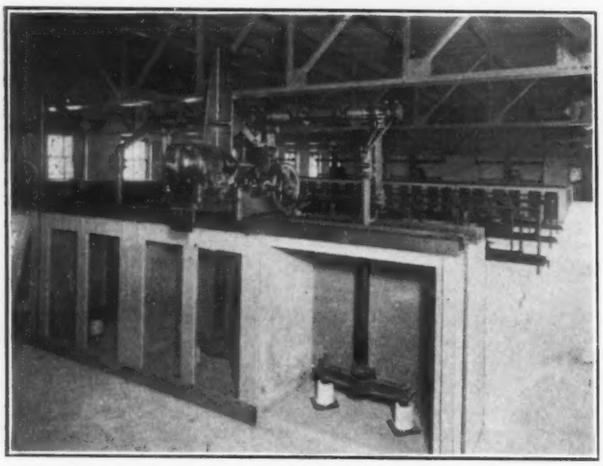


FIG. 9—OPERATING MECHANISM FOR 2000-AMP OIL SWITCHES, NORTHWEST STATION

starting engineer report to the load dispatcher that the work is finished, and that the apparatus is ready for service again. The load dispatcher then orders the "hold cards" removed. These are then signed by the starting engineer and sent to the load dispatcher's office. The apparatus is then put back into regular operation. The foregoing is a simplified statement of the most important safeguards provided to protect the men from harm. So far they have given perfect satisfaction.

The process of putting new apparatus into service follows a similar procedure, the basis of which is a "starting engineer's notice." Copies of this are distributed to the various departments through the load dispatcher's office and guide the load dispatcher in putting new apparatus into service without harm to the various departments interested in the apparatus or lines in question.

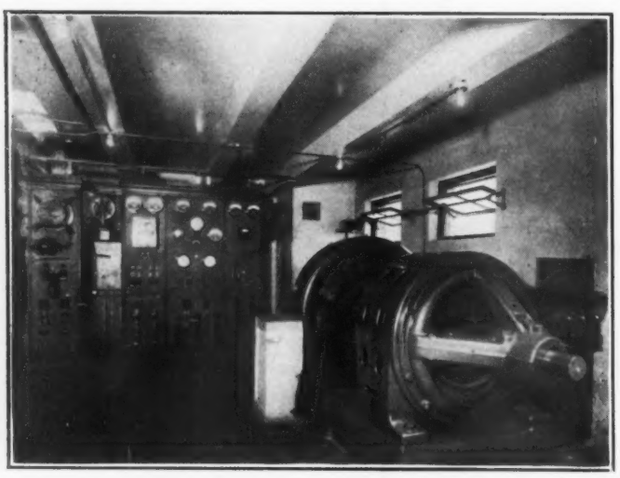


FIG. 10—EXCITER BAY, NORTHWEST STATION

As the load dispatcher must at all times be thoroughly informed in regard to conditions in any part of the system and must have an intimate detailed knowledge of all parts thereof, a complete set of maps is kept in his office, readily accessible at all times. These records show the routes, lengths and sizes of all transmission lines, feeders, circuits and overhead lines. If, for instance, a manhole explosion were reported in any part of the city the load dispatcher could from his maps in a very few minutes have very accurate knowledge of every line, feeder or circuit passing through that manhole. He could at once, therefore, proceed to "kill" all or part of such lines, thereby preventing the trouble from spreading.

As the load dispatcher is responsible for the prompt solution of all problems arising in case of emergency, every facility is afforded him for securing information in the shortest time possible. For this reason a private telephone board, which may be split up into four positions, connects him with all of the different generating stations and substations over leased, direct telephone wires. In case any line or lines should become disabled, connections through the Edison board are also available. By this means the load dispatcher is put in a position to survey the entire system in an intelligent manner and to restore abnormal conditions to normal in the shortest possible time.

Without the load dispatcher's office, which frequently and appropriately has been termed the "nerve center" of the system, the operation of a plant like that of the Commonwealth Edison Company would be practically impossible. The high degree of operating perfection which has

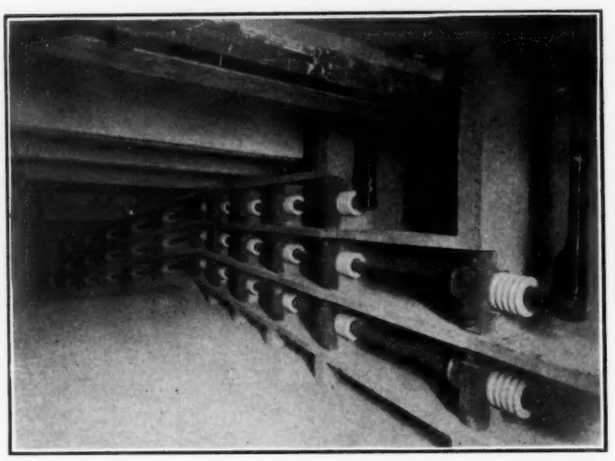


FIG. 11—GENERATOR LEADS IN CABLE VAULT, NORTHWEST STATION

been attained in the system as a whole is due in large measure to this ingeniously conceived and excellently organized department. The operation of the entire system is under the direct charge of Mr. W. L. Abbott, and the chief load dispatcher is Mr. P. B. Juhnke.

Baking by Electricity Cheaper than by Gas

To compare the cost of baking with gas and with electricity an officer of the Utah Light & Railway Company, Salt Lake City, recently undertook a test by baking batches of three ordinary domestic loaves of bread, one batch being baked in a modern gas range and the other in a modern Simplex electric range. In each case the time consumed was the same, approximately one hour and five minutes. The results obtained were also practically identical, although the electrically baked bread was browned a little more than the other, since the operator supposed it was necessary to leave the electric oven at "high heat" longer in order to get the same degree of browning.

At the end of the test the electric meter had registered 1.4 kw-hr., which at the net heating rate of 3.6 cents per kw-hr. would cost 5.04 cents. The gas meter had meanwhile registered 60 cu. ft., which at the net heating rate of 90 cents per 1000 cu. ft. would cost 5.4 cents.

Electrical Service in European Cities

Wide use of tungsten and flame-arc lamps for street lighting—Tungsten lamps used everywhere to the exclusion of the carbon-filament lamps. By Dr. Louis Bell

TO an extent that is by no means fully understood by Americans, tungsten lamps are in general use in Europe. To find a carbon lamp one almost requires a search-warrant, and it is the same story in every European city. Competition in lamps, a cheap though not always first-class product, and no free supply of carbon lamps to encourage false economy in the parsimonious, combine to make the old filament a thing well-nigh forgotten. It is noticeable, too, that the ordinary tungsten lamps in use are rather small, say 40 watts and below. There is no such use of the lamps of 100 watts and above as in America, the practice being to replace carbon by tungsten lamps and let it go at that. Shades are commonly of the most rudimentary character, although now and then one sees some beautiful fixtures with diffusing shades. Here again is the result of cheap lamps. Where there is no great economy in using a few large units, the natural tendency is to put in lamp for lamp and let it go at that. But there certainly is need for illuminating engineering on an all-pervasive scale. As regards the whole lamp matter, the handwriting is on the wall, the universal opinion being that the tungsten lamps will be forced down by competition to the price of the old carbon lamps or very near it, in spite of the fact that 220 rather than 110 must be regarded as the normal voltage.

PARIS

From an electrical standpoint Paris has changed little in recent times. Press-gas, so rampant in London, is used on only one street in Paris, although gas is in evidence everywhere on the side streets, and some of the more important ones, in the usual form of Welsbach burners. In fact, almost the first sign noted was one on the proper use of gas cooking appliances maintained by the gas company.

Street lighting has not very greatly changed; it is still accomplished by means of gas and plenty of it, with old open carbon arc lamps rather common except on the most important streets. The Avenue de l'Opéra is extremely well lighted with flame-arc lamps, light yellow ones, and curiously enough of the vertical-electrode long-burning type, which is relatively little used in England. However, with a row of arc lamps spaced at about 30 m on each side of the street, and another row down the center in aisles of safety, any avenue runs a good chance of being thoroughly lighted. The iron posts, by the way, are uniform in type, whether used for electricity or gas.

The price of electrical energy is much higher in Paris than in London, and the appliance business, actively pushed in England, is, from sheer cost, practically undeveloped in the French capital. There is "nothing doing" with energy at 10 cents per kw-hr. or thereabout. In fact, there is very little in Paris central-station practice which is impressive save the very large use of single-phase motors. They are rather largely of the Lalour compensated-repulsion type and seem to be giving satisfaction even in elevator service. I saw an excellent example of a 30-hp single-phase motor at the Laboratoire Centrale which has been in use now for a year, absolutely sparkless and functioning admirably.

In the front of a restaurant on the Avenue de l'Opéra use is made of Claude's beautiful neon-tube lamps. The color, a magnificent orange red, is conspicuous half the length of the avenue and compels one's attention on the moment. Neon of all known gases seems to have the greatest relative concentration of energy in the visible spectrum and consequently is extremely efficient as an illuminant, the latest tubes working approximately at half a watt per candle. Smaller tubes are now being made up into luminous signs and present a most striking appearance.

Transportation from St. Cloud by way of the tramway is a sort of bad dream. One waits for a train much as at home on a half-starved interurban line, and when the thing finally comes trundling along it is a shock. A compressed-air affair it is, with a dingy two-story motor car dragging a similar trailer at a snail's pace. I am glad to be able to report, however, that the wheezy abomination is near its finish, for the line is rapidly being changed over to electric traction. The trolley wires are supported on brackets from poles on the two sides of the street, well to the side, and the cars have very long trolley poles, inclined to one side. The result is that the overhead structure is, on a street blessed with trees, very inconspicuous indeed, and the arrangement is by no means a bad one.

Paris suffers, like many other cities, from an antiquated system not administered with great activity. There are individual points of striking interest without a striking ensemble. Perhaps the most noticeable thing is the way in which metallic-filament lamps are in general use, to an extent greater than in any American city of the first rank. The cost of lamps in the smaller sizes is, thanks to much competition, very low, even down to 20 cents. On the other hand, on account of the same competition, I have good reason to think that the average metallic-filament lamp is rather bad, not at all so excellent as our own in average life and efficiency. The larger sizes seem relatively scarcer than with us, and the half-watt lamp specter has not yet stalked abroad in Paris.

Quartz-tube mercury-vapor lamps are coming into considerable use for industrial purposes, but perhaps their most notable application is to sterilization of water for domestic, chemical and medical purposes. Some large sterilization plants have been erected, and there has been a large output of small apparatus furnishing from 100 liters to 300 liters of sterile water per hour. One of the latter capacity was used with admirable results in the field hospital of the French Morocco expedition. A process for milk sterilization has also been worked out which seems to promise well although not yet in commercial use. All such devices will ultimately add to the load obtainable from general appliances when our central stations get busy.

BRUSSELS

Brussels, from which I departed on the way to Cologne, has changed little in matters electrical during the past five years. The carbon incandescent lamps have gone, and more flame-arc lamps—white ones of the Blondel type—have come in. Large tungsten lamps are fairly common, and the smaller ones are universal. The Brussels trains are somewhat out of the ordinary in that they are largely on the conduit system, with slot in one track rail, through the center of the city and come in with the trolley pole hooked down but ready for business when they escape from the forbidden territory. They commonly carry trailers

of very diminutive size, so small that one has to shut up like a jack-knife to get into them. From appearances I judge that the trolley wire is working its way inward, and it may be that the conduit will soon be a thing of the past. Cologne is much further advanced in tramway practice, and on some streets one sees admirably decorative center poles carrying the street lights at the top and the trolley wires on long ornamental arms. We are far ahead of European practice so far as the rolling stock is concerned but have much to learn on the construction of decent-looking overhead work for city streets.

Cologne

Despite the aspersions of Coleridge, Cologne has become a beautiful, clean city of about 600,000 population, with a very active municipal electric plant having an output of some 40,000,000 kw-hr. annually. Its streets are well lighted, mostly with flame-arc lamps in the center of the city, and, be it written down to the credit of the government, no attempt has been made to light the cathedral except in the usual course of events. I am afraid that were the cathedral in some cities at home the public would not rest until it had turned a search-lamp beam up each of the spires.

One thing is particularly to be noted all along the line—that so far as general use is concerned, the carbon lamp is practically abandoned in Western Europe. While there probably are a good many hidden here and there, they are not used in public places. Competition has made tungsten lamps cheap, and while many of them are far from good, low cost has done its work in forcing them into use. But, since most cities supply cheap gas, I fancy that those who might stick to the carbon lamp from false economy have never been weaned from gas. The chief relic of the electrical old-timers is an occasional open-arc lamp, but even this is a good one, thanks to high-grade electrodes.

Frankfort

Frankfort is a fine active city possessing an elaborate municipal central station with an annual output of almost 50,000,000 kw-hr. Street lighting is by the usual mixture of flame-arc and gas lamps, but there are some large tungsten lamps on the side. There is, however, lack of the rather common auxiliary gas lamps or incandescent lamps on the arc-lamp poles to take up the work after midnight. Instead, the arc lamps, yellow-flaming ones, are arranged in two alternate circuits, of which one is burned all night, the other only until midnight. In fact, in summer, save on Sundays and holidays, only one circuit is turned on, and that for all night. The theory is not a bad one, that of furnishing light approximately in proportion to the traffic. Such a schedule is likely to run from 3200 to 3300 hours, giving some saving without any real sacrifice.

Leipzig

In Leipzig I saw a new variety of press-gas, using the air supply under pressure instead of the gas. It was stated to give 1000 hefners per mantle, but there are evidently others beside ourselves who forget to change mantles and shut the eye to the accusing photometer, for some of those mantles reminded me strongly of home.

Berlin

In Berlin everything is on the jump. The changes in the last five years have been really tremendous. Perhaps the most striking thing is the immense increase in the number of motor taxicabs, the introduction of motor buses on a considerable scale, and the prodigious strengthening of the street lighting. Of course the city fathers, with nearly $25,000,000 of municipal funds in the gas plant, are somewhat addicted to gas, but whatever the source, flame-arc, press-gas, or the humbler inverted mantle lamp, the illumination is well planned and well executed, and there are very few first-class streets at home as well lighted as some of the distinctly second-class streets of Berlin. And the difference is a very simple one indeed—at home we generally try to make an arc lamp illuminate about double the length of street it can really cope with, while in Berlin lamps are installed to do the work thoroughly; and the costs per lamp are not low, at that.

Munich

Munich is remarkable for a very artistic little steam and water-power station right in the middle of things. Most of the energy, however, is transmitted from works further up the Isar. In Munich is to be seen one of the finest applications of high candle-power incandescents in existence, in the illumination of the Prinz-Regenten Theater. The auditorium, seating over 1200, is admirably lighted by fourteen 1000-hefner-candle tungsten lamps placed close to the ceiling and suitably screened—a very simple and effective arrangement, with lamps practically out of the field of view. Incidentally this theater ought to be seen by every architect in that line of work, for it is far superior to anything known in Europe or America for general suitability and convenience.

Zurich

There are no carbon lamps in sight; everything is tungsten well maintained. Many big tungsten lamps, up to 1000-hefner-candle, are used on the streets with very admirable results. Most of the arc lamps are of the white-flame type. Everything is in a sort of transitional stage—waiting perhaps for the half-watt incandescent lamp.

Dresden

Dresden is interesting from the fact that it is using the large incandescent lamps, up to 1000 cp, for street lighting, replacing 8-amp alternating-current flame-arc lamps of the yellow variety. The change has not brightened up the streets, but one must remember that on the whole the lamps in Dresden are spaced rather more widely than is common in European cities, and that the flame-arc lamps were open ones of high efficiency, good for decidedly more than 1000 cp.

Vienna

Vienna is well lighted, although they still adhere mainly to the old open-arc lamp with plain carbon electrodes of very high quality and sometimes taking as high as 15 amp. On the streets in front of shops there are many yellow-flame arc lamps and also many of the little and intensely brilliant intensified arc lamps. Electric signs are not as common as in Berlin. It would be worth the while of American sign designers to go to Berlin and take a look at things. The German signs are no more ingenious and flamboyant than our own, but they often are most clever in the way of compelling attention.

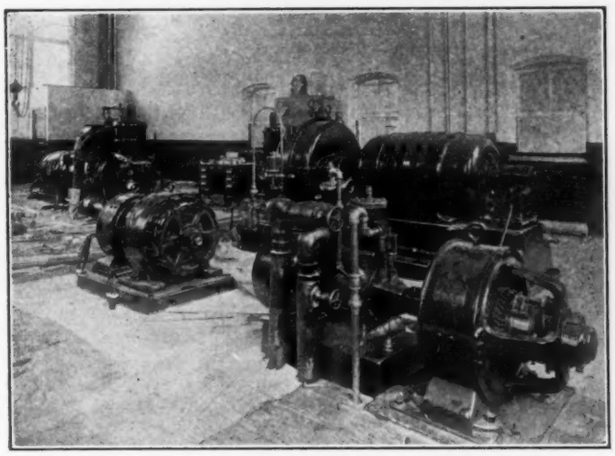
Cheap Wiring

One of the minor things that give one a sort of awestruck feeling in Germany is the kind of interior wiring utilized. Over and over in good hotels I have seen the same thing—twisted wires that look like lamp cord carried not more than a quarter-inch from walls or ceiling all over the room, supported by tiny porcelain knobs forced between the turns of the wire. It probably represents bed-rock minimum cost in wiring an old building. I am informed that it is not half so bad as it looks, being a good grade of rubber-covered wire. Nevertheless, its appearance is against it, particularly after it has been painted a few times. Of course much new wiring is placed in high-grade conduits, the happy-go-lucky construction being used where gas pipes are taken out and the building equipped for electric light. And, after all, so long as the installation does really work as it is expected to, is it not better to have good tungsten lamps thus supplied than the flickering gas of olden times?

A Central Lighting Plant for Rhode Island Textile Mills

The Lonsdale Company, which operates several large textile mills in and about Lonsdale, R. I., has recently put into operation a new steam plant for lighting the Ann and Hope Mill, No. 4 Mill and Bleachery at Lonsdale and the Ashton Mill at Ashton. By this arrangement electrical energy is available for lighting or motor purposes at times when the steam or water-power plants at each mill are shut down. Furthermore, a general system of lighting for the villages can be developed by the company in accordance with the desire of the citizens.

The present generators consist of two Westinghouse turbo-alternators of 250-kva and 375-kva rating respectively. These machines run in parallel at a speed of 3600 r.p.m. and furnish three-phase energy at 2300 volts, 60 cycles. A 10-kw exciter, driven by a small vertical steam engine, is used at starting, and for continuous running a 20-kw motor-generator set is used. The two exciter sets appear in the foreground of the interior view. The turbines operate under a 150-lb. steam pressure and exhaust into a single Le Blanc low-level jet condenser, which is capable of maintaining a 26-in. vacuum when handling 14,500 lb. of steam per hour.



GENERATOR ROOM OF ANN AND HOPE MILL

The water supply for the station is taken from the canal supplying the mills and flows by gravity to a concrete suction well. From this well the boiler-feed pump can draw if necessary, although when the turbines are running the boiler-feed water is taken from the condenser discharge. Should the condenser stop, however, or fail to supply enough water for the boilers, the feed pump immediately draws from the cold well. This change is provided for by a very simple arrangement of piping and takes place automatically without the manipulation of any valves. Before entering the boilers the feed water passes through a closed heater and a Greene economizer.

The first installation of boilers consists of two vertical Corliss boilers, 85 in. in diameter, rated at 223 hp each, good for 185 lb. pressure. These are set on 10-ft. centers and space is provided for two more. Draft is furnished by a brick chimney, 125 ft. high and 5 ft. in diameter, built after the characteristic design of the engineers, who were Messrs. Lockwood, Greene & Company, of Boston, Mass.

The power house is built of red brick and measures 69 ft. by 55 ft. outside, the space being about equally divided between the generator and boiler rooms. There is a high basement under the turbine room used for the condenser, heater and pumps. Ample provision has been made in the building and in the size of the chimney for adding equipment up to double the rating of the present installation. Coal is received on railway cars and dumped into a pocket close to the boiler house, from which it is wheeled across a concrete slab to the firing floor.

The general contractor for the buildings was Mr. William Williams, of Providence, R. I.

Central-Station Construction-Cost Data

In connection with the completion of recent improvements in the plants and systems of several of the Tenney central-station companies in Massachusetts, the following cost data have been obtained. The data are somewhat miscellaneous in character, but can easily be segregated for the compilation of loose-leaf estimate sheets. The companies drawn upon are the Haverhill Electric Company, Malden Electric Company, Fitchburg Gas & Electric Company and Suburban Gas & Electric Company of Revere.

MISCELLANEOUS CENTRAL-STATION CONSTRUCTION DATA

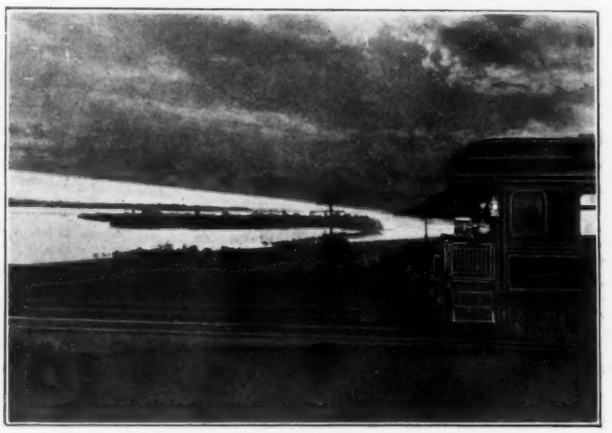
Sea Wall for Haverhill Station, on Merrimac River.	
Granite wall, rough cut stone, backfilled with earth filling; length, 410 ft.; width, 14 ft. to 18 ft.; height, 25 ft.; area, 6329 sq. ft. Cost of material and labor, $17,500; miscellaneous, $1,215; total	$18,715.00
Stock House Vault, Haverhill.	
Built of brick, two stories, 8 ft. by 10 ft. inside dimensions, 8-in. outer wall, 2-in. air space and 8-in. inner wall. Cost, $580; doors, wiring, shelves, etc., $350.08; total cost	930.08
New Generating Unit, Haverhill.	
One 25-kw steam turbine arranged for direct connection and mounted on common bedplate, including one No. 16 Westinghouse LeBlanc condenser and electric generator; erected complete, Westinghouse Machine Company	31,639.00
Miscellaneous Steam and Electric Plant Equipment, Haverhill.	
One 9-in. by 12-in. by 10-in. duplex piston-pattern pump, brass-lined pump cylinders, Tobin bronze piston rods, composition pump pistons, brass valve seats, medium-hard rubber valves for cold water and high lift	405.00
Foundation, pipe connections, etc	401.39
One Sarco CO_2 recorder	326.80
One 6-ft. by 21½-ft. Scannell return tubular boiler removed from service; first cost complete, erected	2,607.30
One 3125-kva, 60-cycle, three-phase, 2300-volt Westinghouse turbo-generator	9,227.87
Switchboard apparatus	955.38
Cable	248.52
Air duct	408.80
Four 60-lamp, 60-cycle, 220-volt, 2.75-amp air-cooled, constant-current transformers	1,040.00
Four series arc oil switches, 9E, type F, form 2, 2.10 amp, 1200 volts	224.00
Ten 25-ft. ornamental arc-lamp poles ($38 each)	380.00
Sixty-eight 30-ft. chestnut poles, painted and shaved ($5.56 each)	377.86
140 35-ft. chestnut poles, painted and shaved ($7.55 each)	1,054.14
Nineteen 40-ft chestnut poles, painted and shaved ($8.75 each)	166.80
One 50-ft. chestnut pole, painted and shaved	10.50
One 60-ft. chestnut pole, painted and shaved	18.75
15,820 ft. (6252 lb.) No. 0, triple-braided, weather-proof, solid wire, at 14.2 cents per lb	889.22
One 30-in. Lumsden & Van Stone steam-exhaust head	189.00
One 16-in. Standard twin strainer, No. 684	428.63
Transformers, All 60-Cycle Equipment.	
Nineteen 1-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each	17.06
Eight 1½-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each	23.13
Twenty-seven 2½-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each	30.68
Thirty 5-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each	49.43
Six 7½-kw 2200-1100-volt primary, 220-volt secondary, single-phase, each	65.17
Six 10-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each	80.95
Three 15-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each	110.67
One 20-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each	137.14

Three 25-kw 2200-kw-1100-volt primary, 575-volt secondary, single-phase, each	$172.86
Six 30-kw 2200-1100 volt primary, 575-volt secondary, single-phase, each	183.82
Three 50-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each	252.70
One 50-kw 2200-1100-volt primary, 220-volt secondary, single-phase, subway type, each	310.88
Meters.	
Sixty-seven 5-amp, 110-volt Fort Wayne type "K3," each	$9.28
546 10-amp, 110-volt Fort Wayne type "K3," each	10.06
Five 15-amp, 110-volt Fort Wayne type "K3," each	13.00
Thirty-three 25-amp, 110-volt Fort Wayne type "K3," each	13.00
Twenty-one 50-amp, 110-volt Fort Wayne type "K3," each	18.68
One 300-amp, 110-volt Fort Wayne type "K3," each	27.00
Two 400-amp, 110-volt Fort Wayne type "K3," each	27.40
Twenty 5 amp, 550-volt Fort Wayne type "K3," each	32.80
Sixteen 10 amp, 550-volt Fort Wayne type "K3," each	33.83
Three 15-amp, 550-volt Fort Wayne type "K3," each	34.80
Thirteen 25-amp, 550-volt Fort Wayne type "K3," each	35.84
Six 50-amp, 550-volt Fort Wayne type "K3," each	39.60
One 150-amp, 550-volt Fort Wayne type "K3," each	66.26
One 200-amp, 550-volt Fort Wayne type "K3," each	51.60
Nine 15-amp Wright demand meters, etch	5.78
Six 75-amp Wright demand meters, each	7.80
Power-Plant Equipment, Fitchburg.	
Five 6-in. G. E. steam-flow meters, type "Ts 2," 200 lb., at $48 each	$240.00
Labor of installing above	24.19
Pipe, fittings and material	31.77
Total ($59.19 per meter)	$295.96
Three 2-in. Squires feed water regulators, at $90 each	$270.00
Labor of installation	44.38
Miscellaneous material, gate valves, pipe, etc	38.37
Total ($117.58 per regulator)	$352.75
Two Murphy automatic smokeless furnaces	$2,868.00
Installation of above	212.21
One 5-hp, 550-volt motor	190.25
Miscellaneous material and labor, oil pan, steel spur, etc	52.28
Total ($1,661.37 per stoker)	$3,322.74
One 13-ft. by 5-ft. straight-blade Sturtevant exhaust fan with engine	$7,220.00
Piping for above	664.74
Labor and material	1,782.83
Total cost of fan installed	$9,667.57
One Sturtevant economizer, 360 tubes, 10 ft. long. Total heating surface, 4903 sq. ft	$5,240.00
Foundation	450.00
One 5-hp motor, including labor	262.00
Miscellaneous material, including pipe, fittings, etc	1,418.94
Total ($1.50 per sq. ft. heating space)	$7,370.94
Ornamental Street-Lighting Fixtures, Fitchburg.	
Ninety-three fixtures, each equipped with four 60-cp, 6.6-amp series incandescent lamps, connected to underground arc system through 1-to-1 transformers and mounted on local street-railway feeder poles	$1,860.00
Labor of installation	1,088.67
Cable and wire	1,838.61
Miscellaneous material, cross-arms, cut-outs, pipes, etc	1,419.58
Total ($66.50 per fixture)	$6,206.86
Malden Plant Equipment.	
One steel structure, forced-draft cooling tower, 2000-kw capacity, complete with foundations	$14,531.47
One Parsons ash ejector, installed, with 16-ton ash tank	2,173.22
Four Kibbs safety feed-water regulators with 2½-in. valve	340.00
Cost of installing above regulators	103.95
One 5-amp, three-phase, 115-volt wattmeter	56.60
One three-phase G. E. electrostatic ground detector	115.51
Three 500-kw indoor-type, oil-cooled 13,200-volt transformers	4,325.00
One 15,000-volt aluminum lightning arrester	477.75
400 ft. 400,000-circ. mil. flame-proof cable for 5000 volts	158.70
Malden Underground Construction Costs.	
27,395 ft. 2½-in. fiber conduit	$923.67
100,830 ft. 3¼-in. fiber conduit	4,394.21
Cost of installing above by contract	48,297.06
Total cost of conduit	$53,614.94
Line to Revere.	
26,896 ft. No. 00, three-conductor cable for 17,000 volts	$28,040.80
Installation, contract at 4.5 cents per ft	1,210.32
Total cost to Revere line	$29,241.12
Cable Installation in Malden.	
22,751.5 ft. No. 00 cable	$12,240.21
31,497.5 ft. No. 0 cable	16,294.42
93,519 ft. No. 6 cable	17,095.27
Cost of drawing in above 147,768 ft. cable	3,859.44
25 G. & W. potheads	709.82
Labor, company's employees	519.20
Miscellaneous items, freight, tape, asbestos cloth, etc	5,283.46
Total	$56,001.92
Liability insurance, miscellaneous materials, labor of employees, etc., on general work	3,865.30
Total additions to underground system	142,723.28
Miscellaneous Items, Malden System.	
Driving 106 ft. 2.5-in. galvanized-iron pipe for cable grounding, at contract rate of $1.75 per ft	$189.14
Company labor and material, including cost of pipe	85.12
Total	$274.26
Revere, Miscellaneous Costs.	
One 68-ft. by 58-ft., one-story cement and brick, steel-trussed garage: building, $5,300; trusses, $566; miscellaneous, $1,413.03 (including labor, $348.91)	$7,279.03
(Included in above one 40 gal. chemical extinguisher on wheels, $144)	
40,000 ft. duct; 3¼-in-1½-in. socket joint conduit	1,895.25
Thirty manholes	572.50
Nineteen 500 watt sign-lighting transformers, at $10.67 each	202.67

Search-Lantern on Observation Car

An additional attraction to railroad travel has been made by the Chicago, Milwaukee & St. Paul Railway Company, which has installed a search-lantern on the train known as the "Fast Mail," leaving St. Paul and Minneapolis every evening for Chicago. The lamp is mounted on the observation-car platform at the end of the train and is in charge of an experienced operator. It provides a means by which the passengers on the train can view the scenery after nightfall. The "St. Paul" railroad runs parallel to the Mississippi River for over 100 miles. The boats, curious rock formations and the features of the landscapes come out clearly in a very interesting manner by the use of the search-lantern.

The search-lantern is 13 in. in diameter and stands on a pedestal 52 in. high over all, taking up 16 sq. in. of floor



SEARCH-LANTERN MOUNTED ON PLATFORM OF OBSERVATION CAR

area on the observation-car platform. The electrodes are 0.5 in. and 0.625 in. in diameter and were made by the General Electric Company especially for search-lantern work. They are placed horizontally and operate automatically after being focused. The lamp is built to operate on the standard 60-volt train-lighting circuit and requires 20 amp. The lantern can be swayed 90 deg. horizontally and 45 deg. vertically. It is said to make objects visible for a distance of two miles.

Central Station Management

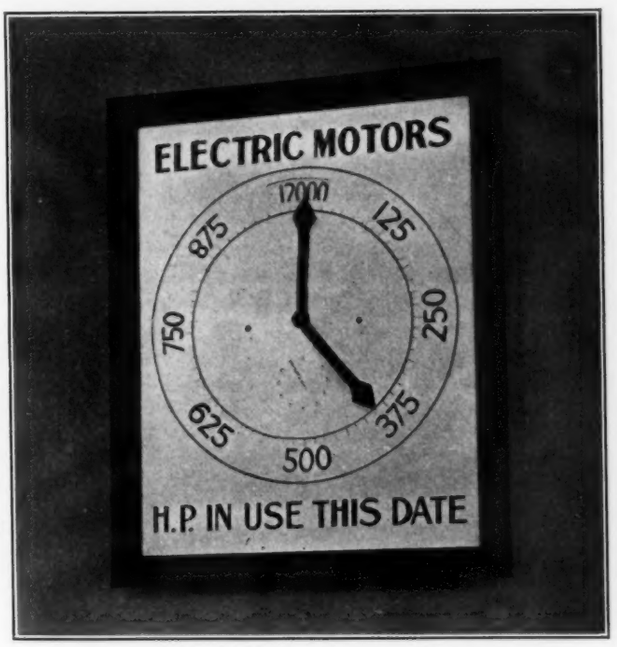
Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Advertising on Envelopes

Many business houses use the backs of envelopes to convey advertising messages, and among them is the Citizens' Electric Company, which supplies electrical energy in Hot Springs, Ark. This company uses envelopes for its business correspondence on which the name of the company does not appear, the return card simply mentioning the name of the city and the number of the post office box. On the back of the envelope, however, is conspicuously printed the following legend: "Do it electrically. Employ a silent salesman. Cost is surprisingly low. Trade comes your way and comes to stay if you use a tungsten electric sign, the modern business getter." The Citizens' company was practically burned out in the big Hot Springs fire of Sept. 5, but it was hoped to resume operation by Sept. 20.

Displaying the Connected Motor Load

The Worcester (Mass.) Electric Light Company has an effective way of calling the attention of visitors in its offices to the growth of the company's motor load, as illustrated in the accompanying half-tone. Attached to the wall at the right of the counter where bills are paid is a 26-in. by 32-in. frame equipped with a 20-in. clock dial graduated in steps of 125 hp from 1 hp to 1000 hp. At the top of the dial is a slot displaying the motor load in thousands of hp,



DEVICE USED TO DISPLAY CONNECTED MOTOR LOAD

and each day the "hour hand" and "minute hand" of the dial are checked and corrected to the total connected motor load on the system. The rear of the dial is provided with an adjustable disk calibrated for large increases in motor load. The illustration shows a motor load of 12,375 hp, a growth of about 7238 hp in the past fourteen months.

Washing-Machine Campaign at Elwood, Ind.

A window display which shows how to save labor in the home is in itself always attractive to housewives, but if the interest of the children can be separately enlisted the mothers will be dragged to the window by their youngsters to wait till the little folks have feasted their eyes on the wonderful sights therein. Such was the washing-

WINDOW DISPLAY OF WASHING MACHINES

machine display recently used in the window of the Elwood Electric Light Company at Elwood, Ind., a town of 11,000 inhabitants. The two lay figures, one with an old washing machine and the other using the new motor-driven type, pointed out the way to make the Monday washing an easy task, while in the foreground two miniature electric trains operating from a third-rail industriously plied back and forth on the figure-eight track. On the miniature pole line the type of overhead construction adopted by the American Gas & Electric Company's properties was rigidly followed, white, brown, blue and yellow beads being used to distinguish primary circuits, secondary circuits, arc-lamp circuits and ground wires respectively, as in the Elwood company's own outdoor plant. The electric trains, of course, were a never-failing source of interest to the younger generation and were the cause of many women stopping to look at the display who would otherwise have hurried past with but a casual glance.

Attention was called to the window display by newspaper advertising in the local papers, and while the subject was before the minds of the citizens solicitors followed up the opportunity, with the result that about thirty washing machines were sold in less than four months. Mr. Oscar Halderman is contract agent for the Elwood company.

Central-Station Service for St. Louis Office Buildings

The sales department of the Union Electric Light & Power Company of St. Louis, under the energetic direction of Mr. F. D. Beardslee, is meeting continued success in its effort to supply electrical energy to the prominent office buildings in St. Louis. The Monward Building, now under construction, will be on the electric-service company's cir-

cuits. It will have a connected load of about 350 kw with a probable demand of about 250 kw. Other buildings recently taken over by the central-station company are those of the Title Guarantee Trust Company, the Hargadine-McKittrick Dry Goods Company, the Pierce Building, the National Bank of Commerce, the Chemical Building and the Central National Bank Building. The total connected load in all these buildings is about 2500 kw. Where isolated plants exist in buildings taken over the central-station company operates them in winter for generating electricity up to the heating requirements of the building. Eleven isolated plants are operated by the central-station company in winter in this manner.

Tungsten-Pendant Campaign at New Orleans

Nearly 3000 tungsten pendants have been added to the lines of the New Orleans Railway & Light Company, according to Mr. W. E. Clement, contracting agent, by means of the rental campaign now under way in the Louisiana city. The fixtures, each complete with an opal ball and a tungsten lamp of 150 watts to 500 watts rating, are leased to customers at a rental of 30 cents per month, which includes free renewals and weekly inspection and cleaning.

TUNGSTEN PENDANTS FOR DEPARTMENT STORE LIGHTING, NEW ORLEANS, LA.

Where possible the customer is asked to sign a six-month contract. In installing the lamps the company will run the few feet of wiring necessary to reach the customer's circuits free of charge. In addition to the monthly rental, 30 cents for each pendant, the customer also pays for the energy consumed at the regular metered rate, which averages 8 cents per kw-hr. Assembled complete the cost to the company of these tungsten-pendant fixtures has averaged $3 each. The accompanying illustration shows a number of the tungsten pendants installed in the department store of D. H. Holmes & Company, on Canal Street, between Dauphin and Bourbon Streets, New Orleans.

The Effect of Courtesy in Delinquent Notices

As a last resort customers' services must sometimes be cut off for non-payment of bills. Mr. Thomas Chandler, superintendent of the Edison Sault Electric Company, Sault Ste. Marie, Mich., cited before the recent Michigan convention an instance of the value of courteous language, even in "cut-off" notices. The electric-lighting company he referred to formerly cut off all delinquent accounts thirty days old, serving such customers with an abrupt cut-off notice quickly succeeding a second notice on the 15th of the month. Receipt of these forms caused much irritation and dissatisfaction, and under this system twenty to thirty customers were cut off each month.

TO AVOID DELAY, PLEASE BRING THIS BILL

You possibly overlooked your electric light bill, which should have been paid before the 15th inst., so we respectfully remind you of it and request that you see that payment reaches us by the 21st inst.

Very truly yours,

_____ _____.

FORM OF DELINQUENT NOTICE

Some time ago, however, the system was changed, the second notice sent out on the 15th of the month being in the improved form reproduced herewith. On the 23d all doubtful customers are next sent statements giving warning of impending cut-off, but worded in the courteous and respectful form shown. Before actually cutting a customer's service off, however, he is always telephoned to or seen by the collector. Under the new plan much more friendly feeling has been engendered. Rarely are more than four or five accounts now cut off each month, and half of these are usually persons who have simply "jumped town."

TO AVOID DELAY, PLEASE BRING YOUR BILL

We again respectfully call your attention to your lighting account, which is past due. Kindly favor us with an immediate settlement. If we do not hear from you by the.....inst., we will assume that our service is no longer desired and shall discontinue same without other notice. A charge of 50 cents will be made to cover the cost of reconnecting where service is discontinued for non-payment.

FORM OF CUT-OFF WARNING NOTICE

Technical Magazines and the Small-Plant Manager

Pointed advice to operators of small electric-light companies was given by Mr. E. G. Robinson, of Arlington, Wash., himself a manager in a town of 2000, at the recent convention of the Northwest Electric Light & Power Association, Seattle, Wash. Concluding an interesting paper on the problems of operation with restricted facilities and staff, he said:

"First, I believe that a successful manager of a small plant must be an engineer and that he should have had a varied and broad experience. The thing that is of prime importance is service. Your service must be faultless or as nearly so as possible. Many are the times in my early experience I fought hot bearings with tallow, graphite, grease, oil, cold water, hot water and soap, etc., but in nearly every case we kept the lamps going. A lazy man or one who won't work when the occasion demands had better not tackle a small plant. Untiring energy is the price of other than mediocre success. There is no argument so effective to keep your men in line as the knowledge that you know the business from alpha to omega, and that if occasion requires you can run the steam plant and right any part of it; that you can put on climbers and hike any pole, or, in short, can do and will do any of their work.

"The manager of such a plant should keep up to date

on the latest and best lighting units and equipment. He should take several of the leading magazines and spend all spare moments in looking over these and use them for reference. To show a customer in a leading technical magazine the solution of some motor problem or some type of lamp installation is a strong and effective argument if it fits the case.

"Another thing which I believe is necessary is the absolute authority of the manager. I have seen plants where the manager was afraid to make any kind of a definite stand for fear the president or some other officer would reverse him or interfere. This condition is certainly deplorable and must result in disrespect for the manager and havoc in the organization. A man with gelatinous spine has no business to be in a position of authority in the electric-light business. He must have a keen appreciation of right and wrong and justice, and have the courage of his convictions. One must be able to discern between the person who has been honestly misled and thinks he has been wronged and the one who is a knave and a deadbeat and needs to be jumped all over roughshod and made to know that his game won't work. One should not be afraid of making an enemy if he is right. 'Be sure you are right, then go ahead.' A well-chosen enemy is often a man's best asset. My enemies have done a great deal to make me some very close and valuable friends.

"To be happy one must keep busy. There are a great many little things that come up which, though not strictly in line with a manager's duties, he can attend to probably better than any one else. Often a customer likes to know that the manager takes a personal interest in his troubles and his wants. This attending to many of the details takes one over the town and offers opportunities to inspect the various parts of the system. Make your customer know that you are vitally interested in his welfare and that you want him to have the rate that suits his circumstances.

"Remember you are a public servant and you are to look to the public for your business. Your personality will go far to making your business a success if you cultivate a spirit of co-operation and forbearance, but know when to draw the line and call a halt. Don't be imposed upon. You must serve two masters. One is the company that employs you and expects to have you make a reasonable profit on the investment, the other the public, to whom you must give value received."

Costs of One Year's Electric Cooking and Heating

Detailed costs of electric cooking and heating in an apartment of six rooms, a bath and a kitchen, occupied by a household of six persons, were presented by Prof. J. T. Morris in a paper read before the British Association for the Advancement of Science, Birmingham, Sept. 10, and abstracted in the following paragraphs.

In general, declared the author, the experience of those who have tried electric cooking has brought out these facts:

(1) Joints of meat and steak are cooked better by electricity than by other means, the electric method requiring also a shorter period of training to enable the attendant to secure good results.

(2) The heavy work in the kitchen is largely reduced, owing to the fact that there is less coal to be handled and there is no kitchen range to be cleaned and polished every morning.

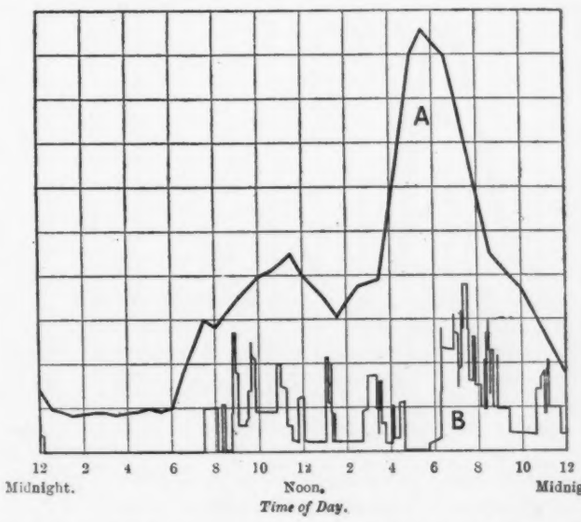
(3) The certainty that if the same time is given for the same operation exactly the same result will be produced.

(4) The convenience and cleanliness and the avoidance of an unhealthful hot atmosphere in the kitchen.

It must be admitted, however, that difficulty is experienced in the supply of hot water in large quantities, as for washing and for baths, where either the electric cooker or the ordinary gas cooker is used. Another difficulty is the heating of the kitchen in cold weather.

In the experiments quoted herewith the equipment used consisted of the Jackson (Marylebone) apparatus which is listed in Table I, with the average energy consumption per hour for each unit part.

The hot-water supply was obtained from a coke boiler, 32 in. high, 14 in. wide and 14 in. deep. As it was not large, it was set in a recess and gave very little trouble. It required lighting in the morning and stoking with coke two or three times a day, and burned practically any kind of rubbish. When electric cooking is used it is found that the kitchen is a much more healthful place. The extra warmth required in winter can be obtained from the coke



CURVES COMPARING STATION LOAD WITH CUSTOMERS' COOKING, HEATING AND LIGHTING DEMANDS

boiler by leaving its doors open, though naturally it is not then so efficient for heating water.

Tables II and III give the number of kilowatt-hours used each week and each day for five or six persons for a period of ten months. It will be seen that, neglecting exceptional cases, this quantity varies from 5 kw-hr. to 15 kw-hr., depending on the amount of cooking required. The "record" consumption, which occurred Dec. 16, was due, as might be guessed, to the Christmas pudding. The average daily consumption over the whole period was 9.75 units, which, at one half-penny or one cent per kw-hr., would amount to less than 10 cents per day.

TABLE I—HOURLY CONSUMPTION OF COOKING APPARATUS

	Kilowatt-hours Consumed per Hour		
	Low	Medium	High
Hot-plate for boiling	0.36	0.67	1.34
Hot-plate for boiling	0.36	0.70	1.39
Hot-plate for simmering	0.24	0.48	0.94
Grille	....	....	1.34
Oven, 36 in. high, 30 in. wide and 24 in. deep	1.06	2.11	3.17

Over the same period of ten months the quantity of coke used was six chaldrons, costing $22.75, which, taking into account the wood needed to light the fire each morning, comes out at 8 cents per day. Hence the running costs for electrical energy to the cooker and for the supply of hot water for all household purposes amounted to less than 18 cents per day.

It should be noted that in one room a coal fire was used for part of the period, and therefore the figures for heating are smaller than they would otherwise have been. Further, it should be remarked that there are no gas pipes that this cooking, heating and lighting load does not reach its maximum at the same time as that at which the peak load of the generating station occurs.

As to safety in use, it may fairly be claimed that of the three most common methods of cooking food the electric cooker is, when properly installed, by far the safest. There is no chimney to get on fire, nor is there danger from stray cinders, or of explosions, unpleasant fumes or "firing back."

TABLE II—WEEKLY KILOWATT-HOUR CONSUMPTION FOR COOKING, HEATING AND LIGHTING, SEPT. 29, 1912, TO JULY 27, 1913

Week Ending	October, 1912				November, 1912				December, 1912					January, 1913				February, 1913			
	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23
Cooking	72	56	75	65	62	66	72	77	61	62	64	100	50	48	65	71	77	71	62	50	63
Heating	51	31	50	50	31	46	90	45	55	82	42	37	31	45	74	84	68	80	63	58	60
Lighting	4	3.5	3.5	4.5	5	5.5	5	5.5	5.5	5.5	6.5	5.5	5	6	6.2	6	6.5	6.5	6	5.5	4

Week Ending	March, 1913					April, 1913				May, 1913				June, 1913					July, 1913			
	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27
Cooking	65	68	68	72	72	70	84	64	61	89	84	79	90	80	73	66	52	78	55	56	56	63
Heating	49	50	61	92	94	96	129	79	48	30	55	55	32	1	4	3	2	2	1	5	4	3
Lighting	5	6	5	4	4	4	6	5.1	4.1	4.5	4.5	4.2	3.5	3.2	3.4	3.1	2.4	3.2	3.3	3.1	3.1	3.3

Weekly Average: 68.2—Cooking; 48.1—Heating; 4.6—Lighting.

in the flat. The maximum weekly consumption for heating is 129 kw-hr., and this was due to the presence of visitors.

For lighting the maximum weekly consumption was 6.5 kw-hr., costing 6.5 cents per week. It is interesting to note that this amount is insignificant in comparison with that of the annual charge, but it should be remembered that this annual charge covers all uses of electricity, though based on the maximum possible lighting load.

In comparing this method of heating and cooking with methods in which coal is used, it must be borne in mind that a saving of from $125 to $150 has been made in the cost of domestic service, and therefore on the above tariff it is an indisputable fact that a considerable gain has been made on the score of economy, cleanliness and independence.

A typical load curve is given herewith showing the total power taken for all electrical purposes in the flat on Monday, Jan. 20, 1913 (weather, fair; temperature 45 deg. Fahr.). Alongside it is shown the station load for the same day, though to a very different scale. These curves are placed on the same chart with the object of showing

Following is a statement of the individual charges which go to make up the total expenditure throughout the year from July 27, 1912, to July 26, 1913:

Annual charge	$32.50
Rental of cooker, at $3.75 per quarter	15.00
Cooking, 2934 kw-hr., at 1 cent per kw-hr	29.34
Heating, 2068 kw-hr., at 1 cent per kw-hr	20.68
Lighting, 200 kw-hr., at 1 cent per kw-hr	2.00
	$99.52
Coke and wood	22.75
Total	$122.27

TABLE III—DAILY ENERGY CONSUMPTION FOR COOKING, IN KW-HR., FOR THE PERIOD SEPT. 29, 1912, TO JULY 26, 1913

Week Ending	October, 1912				November, 1912					December, 1912				January, 1913				February, 1913			
	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22
Sunday	6	4	7	5	5	5	6	6	8	5	5	5	6	5	6	6	7	7	5	6	12
Monday	5	6	9	9	5	8	8	8	5	7	21	36	7	5	6	8	13	6	6	5	6
Tuesday	12	11	14	13	9	11	11	13	12	14	6	17	10	4	12	13	13	9	6	8	11
Wednesday	11	11	11	6	11	14	13	6	9	7	6	10	13	5	8	9	12	10	9	7	6
Thursday	9	7	8	9	9	7	8	17	12	9	8	11	5	9	8	9	6	11	12	10	10
Friday	15	6	13	10	11	8	12	13	6	8	7	7	3	7	13	11	9	12	10	5	10
Saturday	14	12	14	12	12	12	14	12	11	12	13	13	6	13	12	14	17	17	12	6	12
Weekly total	72	57	76	64	62	65	72	75	63	62	66	99	50	48	65	70	77	72	60	47	67

Week Ending	March, 1913					April, 1913				May, 1913					June, 1913				July, 1913			
	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26
Sunday	7	6	6	9	8	6	8	7	8	7	12	13	10	14	8	8	5	8	8	4	5	5
Monday	4	10	8	8	7	11	7	9	6	14	10	8	8	10	10	8	6	9	7	4	4	13
Tuesday	13	13	10	11	10	12	11	10	10	11	15	9	13	12	10	11	6	15	8	7	11	8
Wednesday	8	10	8	8	12	12	12	7	6	15	14	13	13	14	11	10	2	9	9	13	6	7
Thursday	10	8	14	14	7	10	11	15	10	12	10	11	15	11	9	11	10	14	8	10	9	9
Friday	12	8	10	9	14	7	16	6	7	10	11	14	13	10	10	11	11	13	7	8	9	10
Saturday	11	14	10	15	13	11	18	11	15	16	12	13	14	15	14	9	10	10	9	11	12	10
Weekly total	65	69	66	74	71	69	83	65	62	85	84	81	86	86	72	68	50	78	56	57	56	62

There is also the great advantage of perfect cleanliness. Saucepans, for instance, can never become sooty outside. This fact alone saves a not inconsiderable amount of labor. Then, too, the walls and ceiling of the kitchen remain much longer clean.

GRIPPER AND SIDE GUIDE

Illumination and Wiring

Lighting the Way Off the Traveled Path

The Majestic Theater, Fort Worth, Tex., is located one square back from the main street of the city. To attract the attention and patronage of the public in the more traveled thoroughfare the theater management has therefore arranged to have the connecting alleyway lighted by the elaborate tungsten installation shown herewith. At intervals ornamental steel posts on each side of the street support 250-watt lamps covered by porcelain enameled shades, which take the place of gar "arcs" formerly used. In addition to the 250-watt lamps, the principal spectacular effect is furnished by strings of 40-watt lamps run down each side of the street. These conduit lines are suspended from the steel posts and are securely braced by small channel irons. Each line of sockets at the side of the street contains 100 such 40-watt tungsten lamps.

ALLEYWAY LIGHTING AT FORT WORTH, TEX.

The arch over the entrance to the street is made of wire mesh, the letters being of wood coated with goldleaf. The lamps on the arch are also 40-watt tungsten units. The entire installation is, of course, a great improvement over the gas-arc lighting previously used. The management of the theater is very highly pleased with the illumination obtained, attributing the large increase in its business this season to this display lighting.

Electric-Sign Regulation at Boston

A new law relative to the display of signs, awnings and other projections in the public ways of Boston, Mass. (Chapter 680, Acts of 1913), became effective on Aug. 12, by the terms of which the board of street commissioners has complete authority to regulate the placing of all such structures and to prescribe the conditions under which they may be used. A maximum fee of $1 per sign permit may be assessed. The act does not apply to poles, wires, conduits and other distributing equipment for public utility service. Hearings were begun by the board a few days ago for the purpose of preparing sign regulations and tentative rules were discussed. According to present plans the board will require that signs affixed to buildings at right angles must clear the sidewalk by 10 ft; unilluminated signs may project not over 1 ft. over the walk, illuminated signs not more than 4 ft. To guarantee that these signs are safely supported and properly wired inspection by the city building department and by the city wire department is to be required.

Magnetite-Arc Lamps at Owatonna, Minn.

The city of Owatonna, Minn., recently installed fifty magnetic-arc lamps of the inverted ornamental type. This installation was put in from the proceeds of a bond issue, the work being done by the city with day labor.

Energy is furnished by the Public Service Operating Company of Owatonna at 5 cents per kw-hr. measured at the switch. The city furnishes electrodes, rectifier tubes and other necessaries, and makes repairs. The electric company trims the lamps. To date, the cost of energy has been 3.04 cents per lamp-hour.

The conductors are inclosed in 2-in. iron conduit laid behind the curbs. The cable used is No. 6 stranded, covered with a 0.219-in. layer of 30 per cent Para braided rubber and 0.047 in. of lead. Specifications called for a working pressure of 7500 volts and a breakdown test of 16,000 volts, which was withstood in a test at the University of Minnesota.

COST OF INSTALLING FIFTY MAGNETITE-ARC LAMPS ON POSTS AT OWATONNA, MINN.

Fifty lamps, at $35 each	$1,750.00
Fifty cut-outs and lightning arresters	231.50
8,500 ft. 2-in. iron conduit, at $12.82 per 100 ft	1,089.70
9,000 ft. cable, at 17¼ cents per ft	1,552.50
600 ft. connecting cable	80.19
Fifty posts, cast iron, 600 lb. each, at $25	1,250.00
Extra fittings and repairs to tools	19.81
Freight	173.47
Labor	468.25
Cement, twenty-five sacks, at 50 cents	12.50
Total	$6,627.92
ost of rectifier	1,900.00
Total, including rectifier	$8,527.92

In Fig. 1 is shown a single lamp-post. Each post has a base 14 in. square and is painted a French green, the caps included. The rich red-brown color of the insulators helps to enliven the appearance. The posts are made of cast iron and weigh 600 lb. each. The lamps are of the magnetite-arc type, requiring 6.6 amp, and were manufactured by the General Electric Company. The standards are spaced at an average distance of about 90 ft. measured along the street, and are staggered, four being used in a 280-ft. block and six in a 462-ft. block. The installation lights 5325 linear ft. of street, illuminating a pavement area estimated at 29,184 sq. yd.

The accompanying table gives the cost of the installation in detail. The rectifier was bought by the Public Service Operating Company with the understanding that if the city ceased using the company's service within ten years the city would purchase the rectifier, paying one-tenth of the original cost for each year from the time the company's service was discontinued till the ten years expired.

FIGS. 1 AND 2—SINGLE LAMP-POST AND NIGHT ILLUMINATION AT OWATONNA, MINN.

European and American Wiring Practice

By A. H. Bernhard

In a previous article (Jan. 11, 1913) the writer described the flexible-cord system of wiring as used in European countries, especially France and Italy. While that is probably the most used method of interior wiring for circuits of small current-carrying capacity in finished houses, a great deal of wooden molding is also used, chiefly in combination with flexible-cord wiring for ceiling circuits. Although the use of wooden molding for wires has been prohibited in Germany, Austria and Switzerland, and the writer believes in Italy also, wiring in molding is very popular in France on account of its low cost and sightliness as compared with open wiring on cleats or porcelain knobs.

Wiring in Molding

Wooden molding in France is proportioned differently from American molding. Owing to the prevalent use of No. 19 unbraided wire for branch circuits, narrow molding with very small slots is considered ample. It cannot be denied that this type of construction permits making a very neat and inconspicuous job, especially as no bulky porcelain devices are used at junctions. The division between the slots of the wooden molding is cut out with a chisel to make room for such splices as are necessary, and after these are made the cap of the molding covers them completely.

This molding is generally made of pine and is often nailed unpainted against brick walls in cellars, hotel kitchens, laundries and other damp places. The outside of the completed molding may subsequently be painted to match the decorations of the place in which it is installed, but while in France the writer saw no wooden molding painted on the inside except that installed under his direction. In many instances wiring is installed on the outside walls of buildings in molding with slots large enough to contain lead-covered conductors.

No effort is made in France to supply special types of snap-switches, receptacles, rosettes, etc., to fit wooden molding. When any wiring device is to be attached to a circuit the molding is cut off at the proper place and a thin wooden block is fastened to the wall or ceiling. The wiring device is attached to this block after slots have been cut and holes bored in its back to admit of the wires.

French and Italian practice (and, to a great extent, that of other European countries as well) avoids centralizing branch-circuit fuses and switches on panelboards, as is done in America. If the wiring is done with wooden molding, with flexible cord, with cleats or knobs, or even with conduit, it is usual to place a fuse for each lamp or group of lamps where the branch circuit is tapped into the mains. For small branch circuits carrying currents as high as 5 amp a very popular scheme is to place a single-pole open-wire fuse inside the cover of the snap-switch controlling the circuit. In this way practically each lamp is protected by a separate cut-out, so that if trouble occurs with one lamp the others will not be affected. The experience of the writer has been that these small fuses give much more trouble than they are worth, and that the American system of bringing all branch circuits to a panelboard, and equipping the panelboard with a double-pole cut-out for each circuit is by far the better plan. The writer believes that no conductor of less than 1.6 mm in diameter (No. 14) should be used (excepting flexible cords), as the difference in cost over smaller wire is insignificant in comparison with the superior mechanical strength and conductivity.

Wire

Excellent rubber-covered wire of the better grades is supplied by the reputable manufacturers in France and Italy and is usually listed under trade denominations.

Probably 90 per cent of this wire is supplied taped, without even a single braid, as single-braided wire costs about 20 per cent more than unbraided and is not considered worth the difference. The writer saw no double-braided or triple-braided wire in Europe, except perhaps in flexible cables for portable lamps and motors. The trade designations follow:

Light vulcanized rubber insulation (unguaranteed).
Medium vulcanized rubber insulation (unguaranteed).
Heavy vulcanized rubber insulation (unguaranteed).
Vulcanized rubber insulation, guaranteed insulation resistance of 300 megohms per km after twenty-four hours' immersion in water at 15 deg. C.
Vulcanized rubber insulation, guaranteed 600 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 1200 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 3000 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 5000 megohms after twenty-four hours' immersion at 24 deg. C.

All the above grades of wire are also furnished with lead sheaths. These lead-covered wires are very popular in France and Italy for outdoor work and for work in damp places when the wires are not supported on insulators. In such installations the wires are held in place by means of small strips of sheet zinc tacked to the supporting surface. This type of construction is preferred to iron conduit as being cheaper and quicker to install.

There is no National Electrical Code in France, but most of the central-station companies make rules of their own in regard to wiring. For instance, most of the rule books issued by these companies lay great stress on the necessity of using only copper conductors of at least 98 per cent conductivity. A guaranteed insulation resistance of 300 megohms per km is generally specified for all insulated wire except flexible cords. It is recommended that all joints be soldered, using only rosin as a flux. The other rules are mostly unimportant.

The writer's experience has been that the enforcement of the above rules is largely subject to the contractor's wishes, especially the rule concerning soldered joints. In fact, it is almost necessary to supervise personally the making of each joint, in order to be sure that the wireman will actually take the trouble to solder it, so little do French wiremen seem to be accustomed to the use of solder when splicing small wires on interior house wiring. There seems to be considerable hesitation on the part of French central-station companies about enforcing their wiring rules, their legal right to do so not being clearly established.

In European countries conductors having a diameter of 0.9 mm (No. 19) are very commonly used for branch circuits feeding up to three or four lamps. Contractors using other methods have often been accused of squandering money by using wire of a diameter of 1.6 mm (No. 14) for all branch circuits. Experience in conduit work has shown that even a single braid is not absolutely necessary, and often it has been found preferable to eliminate the costly braid and apply the saving in price toward the substitution of wire with 600 megohms per km insulation resistance instead of 300 megohms.

Knob and Tube Work

Besides being preferred to molding in Germany, Austria and Switzerland, open wiring with cleats and knobs is very popular in Italy, and to a lesser extent in France. However well work of this kind may be done, the wires are sure to sag and look untidy in a very short time, making this style of construction entirely out of place in residences, stores, hotels, etc., where it is quite commonly seen in Europe. Although wire covered with fancy mercerized cotton braid of a color to harmonize with the surroundings is often used, the unsightliness of this type of wiring offends the French taste, and molding is therefore used generally in France. When Swiss or German contractors do wiring in France, however, they frequently use cleat or knob wiring, as in their own countries the use

of molding is no longer approved. For installations in factories, cellars, damp places, etc., cleat or knob work is considered good practice even in France, and is used quite extensively. Special wire without rubber insulation is used as a rule for work in such locations.

A great many small cleats with two grooves about an inch apart and only one screw hole are used for branch circuits, but these are hardly advisable. However, a type of cleat which has come into use in part of France since the Marseilles International Electrical Exposition of 1908 is considered very meritorious. It is made of greenish glass, about 3 in. wide over all and 1.25 in. broad, and is provided with three grooves for wire up to about No. 12 in size. There are two screw holes for fastening. The great advantages of this type of cleat consist not only in the broad bearing space provided for the wires but also in the fact that it is furnished with two high legs which keep the wires about 1¼ in. from the supporting surface. Although the distance maintained between wires in this cleat is less than that of American types, the writer believes that it could be widely used here to advantage.

Ordinary insulating knobs are practically the same in Europe as here, although the absence of wooden lathing in houses of European construction often makes it inconvenient to attach the knobs by screws to the plastered walls. Hence the knobs are commonly supplied, singly and "in gangs," mounted with machine screws upon galvanized iron strips provided with projections adapted to be plastered into holes cut in the walls or ceilings. This is a great convenience where knobs are used on stone, brick, hollow-tile or reinforced-concrete construction.

Outdoor work is generally done with porcelain or glass insulators, and at present bare copper wire is used almost exclusively for this work. The one point which is most noticeable in European insulator work is the fact that cross-arms are rarely used, each insulator being attached to the pole or wall by a separate galvanized-iron bracket.

Recent Telephone Patents

Ringing is usually accomplished by the use of alternating current, but in a system invented by Mr. O. M. Leich, of Genoa, Ill., direct current is used with a vibrating polarized-type bell. The invention lies in the arrangement of the circuits so that the potential normally maintained on the line will not affect the bell. A reversed current is applied when the ringing key is operated. Mr. Leich's patent is assigned to the Cracraft-Leich Electric Company.

Mr. C. V. Richey, of Washington, D. C., has patented a register or lock-out system in which apparatus is used that may be actuated by the operator by ringing back on the calling line. The ringing-back operation sets the counter, and the subscriber completes the count by restoring the hook switch in replacing the receiver. The same apparatus may serve as a lock-out by holding open the transmitter circuit until the operator rings back.

The lock-out system patented by Mr. R. C. M. Hastings, of Columbus, Ohio, is a step-by-step system in which a selective mechanism at the exchange and circuit-changing devices at the stations must operate synchronously.

A step-by-step system for which a patent has been issued to Mr. E. E. Kleinschmidt, of Brooklyn, N. Y., is designed for railway dispatching work. The novelty lies in the rise of a common battery sufficient for all stations, all parts, including the battery, being bridged on the line. This patent is assigned to the General Railway Equipment Company.

An improvement in automatic systems has been made by Mr. J. N. Reynolds, of Greenwich, Conn., the patent being assigned to the Western Electric Company. The object is to make the operation of the connecting machines more positive by rendering them irresponsive to an accidental current impulse after the selection of the digit.

Letter to the Editors

Merits and the Early History of Some Phase-Transforming Systems

To the Editors of the Electrical World:

SIRS:—The peculiarity of systems in which currents of one number of phases are changed into currents of another number of phases lies in the method and means for effecting the transformation. Each portion of the system with its given number of phases is precisely the same and operates in the same way as if the system were of that number of phases throughout. For instance, if three-phase currents are generated and supplied to apparatus from which two-phase currents are obtained and utilized, the three-phase portion of the system behaves like any three-phase system and the two-phase portion behaves like any two-phase system.

One method of effecting a transformation from one-phase to two-phase was patented by Dr. Charles P. Steinmetz. This method is practised by using two transformers so constructed that the reluctances of the magnetic circuits are different, by winding on the magnetic circuits in series two primary coils having different numbers of turns, and by making provision for short-circuited secondaries around the magnetic circuits of the two transformers, these coils being in series and having a variable resistance in their circuit. Phase differences are obtained by using a number of transformers equal to the number of phases, and by modifying the flux in the magnetic circuits of the transformers so that there is a phase difference between the currents in the secondary circuits.

The real purpose of this method (at the time the patent was granted) was a change in the magnetic fluxes in the circuits of induction motors or of transformers to produce

FIG. 1—EARLY TWO-PHASE TO THREE-PHASE CONNECTION AND MODIFICATION

two fluxes differing in phase from a single alternating current and to utilize these differences in phase to operate induction motors; in other words, to produce from a single-phase current a "split-phase" current, that is, a current with two phases, known and practised long before Dr. Steinmetz mentioned it in this way.

On Dec. 26, 1893, Mr. Nikola Tesla obtained a patent on this identical method, that is, the production of a two-phase system from an initial single-phase current. On Jan. 27, 1891, a patent was issued to Mr. Tesla on the same line of invention, while on Dec. 3, 1889, a patent was issued to Mr. Tesla in which it was shown that alternating currents of different phases can be obtained from a single-phase alternating current.

On Aug. 14, 1888, Mr. O. B. Shallenberger obtained a patent for a method of obtaining two currents differing in phase from a single-phase circuit. On July 7, 1891, Mr. M. von Dolivo-Dobrowolsky patented a system in which he claimed " . . . transformation from a polyphase current of one number of phases to a polyphase current of another number of phases. . . ." The only disclosure of Steinmetz is a method of splitting a single-phase current into a two-phase current—something that had been done in the art long prior to the date of his application. However, the point which stimulated its special mention here is that in reading through the clauses of his patent one finds the wording so broadened that it extends far beyond the speci-

fication, so that the patent, if interpreted by its wording, might include the transformation of polyphase currents of one number of phases to polyphase currents of another number of phases, as if he were the first to accomplish this in any way, whereas, as we have seen, Tesla and others had preceded him. In 1891 Dobrowolsky showed a large number of dispositions of apparatus by which polyphase cur-

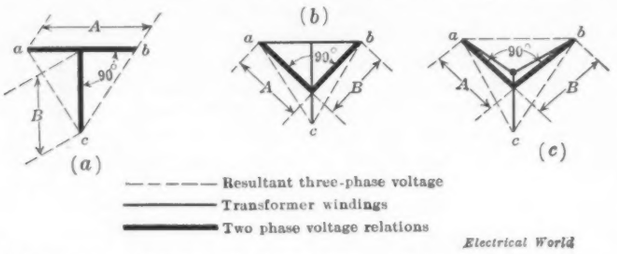


FIG. 2—T-CONNECTED TRANSFORMERS AND PRACTICAL MODIFICATIONS

rents of one number of phases are transformed into polyphase currents of another number of phases. This early system of transformation of Dobrowolsky's covers many phase relations, including all those commercially used at the present time—that is, 30, 45, 60, 90, 120, etc., deg.—and, in fact, is the system of connections by which the well-known "T" system (first patented by Mr. Charles F. Scott) was made known to the electrical field; hence the real original of the "Scott" connection was the Dobrowolsky system, claimed subsequently by Steinmetz.

In the last paragraph it is stated that Shallenberger disclosed one method in 1888; the same year (Sept. 8, 1888) he brought out another method clearly describing the application of resultants, and he produces from two-phase currents a resultant phase—hence three-phase currents, or two-phase to three-phase (see Fig. 1).

The connection *a* of Fig. 1 was modified by Scott, as is shown at *b;* that is, instead of connecting the winding at the extreme end as at *a*, Scott connected one of the transformer windings to the approximate center point of the other.

It is very interesting to review the history of the "Scott-Steinmetz" three-phase to two-phase system shown in vector diagram *b* of Fig. 1. In the year 1894 a patent was granted to Mr. Charles F. Scott for the "T" three-phase to two-phase transformation (using two transformers). Prior to this (1892) Huton & LeBlanc had obtained a patent on a similar method. Not many years passed before the General Electric Company (Steinmetz) came along with the same thing on which Scott obtained his patent. An interference was instituted and priority was granted to each in turn. The examiner of interferences granted priority to Scott. On appeal, the board of examiners-in-chief awarded priority of the issue in interference to Hutin & LeBlanc,

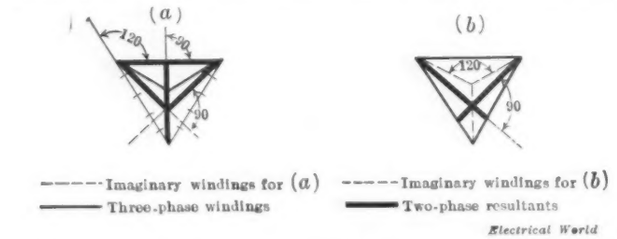


FIG. 3—SIMILARITY OF T-CONNECTED TRANSFORMERS

while on a further appeal the Commissioner of Patents reversed the decision of the board of examiners-in-chief and awarded the priority to Steinmetz. The other parties appealed to the court. By this time, however, it is generally understood that the patent interests of the General Electric Company and Westinghouse company had been the subject of agreement and were practically identical. During this year the Huton & LeBlanc interests and patents were contracted for and controlled by Mr. George Westinghouse. The three contestants had come under a single control and they immediately ceased to contest. The appeals were withdrawn, and a decision by the court was thereby avoided. A patent was then issued to Steinmetz after the Scott patent on the same arrangement was twelve years old. The advantage of having a new patent issued after another patent on the same method was twelve years old is quite obvious.

In March, 1894, Mr. Charles F. Scott read a paper before the National Electric Light Association on "Polyphase Transmission" in which he treated the "Scott" system. In referring to the new system, he said: "In considering the marked advantages of the two-phase system of distribution and of the three-phase system for transmission, it occurred to me that a combination of the two-phase systems might secure the advantage of both in a combined system, and I have worked out a simple and effective method of accomplishing this result."

No public mention of any kind before any society or any engineering body or the like was made by any person or persons prior to March, 1894. During the discussion of a paper read by Mr. Charles F. Scott before the National Electrical Congress in 1893 Dr. Charles P. Steinmetz said: "Now, with regard to the polyphase and the single alternating current, it makes no difference how many phases you use because any system of polyphase currents can be transformed into any other system of polyphase currents by using two transformers. . . . If I may be per-

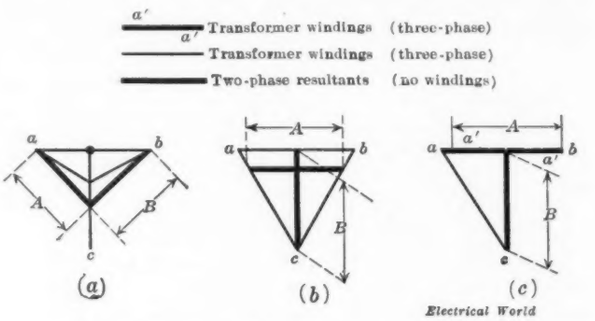


FIG. 4—METHODS OF TRANSFORMING PHASES WITH THREE TRANSFORMERS

mitted to take a look into the future, although we do not know what to-morrow will bring, I think the system of the future will be the single-phase system." This clearly goes to show that Steinmetz had no faith in any polyphase system sufficient to warrant him to attempt to solve the two-transformer Scott system prior to the reading of the paper by Scott in 1894, and the polyphase conversion is but a repetition of the Dobrowolsky method of 1891, already referred to. In his patent Dobrowolsky stated that "the three-phase currents may again be changed by passing through other transformers into a different number of currents," and with respect to the different systems of transmission that might be used, he went on further to say: ". . . The mains may be arranged in circuit with the coils of the transformers in the ordinary manner or by means of the system of connections in which each main forms a circuit with one of the other mains and one or more of the transformers (or transformer coils), and which I shall call 'concatenated circuits,' the said system requiring only as many mains as there are currents to be transmitted, but in this system a common return wire may be introduced." Hence, before the year 1890 Tesla, Bradley, Dobrowolsky and others jointly and in part disclosed all the methods of electrical transmission, transformation and distribution which are in common practice at the present time.

In Fig. 2*a* is shown the ordinary "T" or Scott connection

and two modifications, *2b* and *2c*, of this, as presented by Steinmetz in his patent case against Scott. In reality the three methods are decidedly distinct; that is to say, each has its particular distinction from any other, as:

(a) * * * Consists of two single-phase transformers of equal ratios or one differing in ratio approximately 13 per cent from the other. The main transformer, which

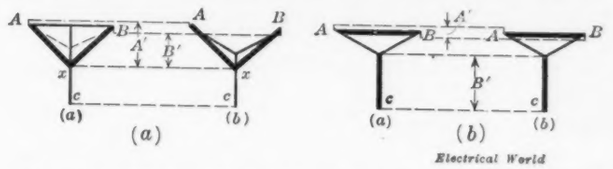


FIG. 5—THREE-PHASE-TWO-PHASE FROM THREE-PHASE SYSTEM

is always the one having the 100 per cent ratio, has a center tap provided to which the extreme end of the other transformer is connected. Applying three-phase currents to the three remaining ends of these two transformers—that is, impressing three single-phase currents, each differing by 120 per cent—two-phase currents are obtained from the secondaries.

(b) * * * This consists in using the same transformers and the same center of connection; in fact, it is identical in all respects with *a* so far as it goes, but it extends beyond *a*. A difference exists and to such an extent as to make the method employed quite distinct from either *a* or *c* of Fig. 2. The distinctions are fourfold, namely, first, provision for a special connection on the "supplementary" transformer in order to obtain the desired two-phase relations; second, the two-phase relations are resultants and are out of phase with those of *a* of Fig. 2; third, the two-phase resultant voltages are much less; fourth, the two-phase voltages are of three-wire.

(c) This method has so many disadvantages as to make it almost useless, principally because the connection of coils on the 120 deg. "Y" system is objectionable and unreliable for safe operation. Its distinctions from any of the other two are, first, that a specially designed transformer is required to handle correctly the two-phase resultants, and, second, that if three single-phase transformers are provided they may be of the ordinary design, but a special tap is necessary for at least one transformer.

Of the three different methods employed in obtaining secondary two-phase currents, the most reliable and the cheapest is the Scott method. Method (c) may be reckoned as taking its origin from the "delta" form, as shown in Fig. 3*b*.

According to the method *a* of Fig. 3, the transformer windings are connected in *Y*, while those of *b* are delta-connected, but the voltages of the corresponding phases in *a* and *b* are in phase with each other, *b* having a greater two-phase voltage than *a*.

Fig. 3, *a* and *b*, are to be classed as coming under the heading of two-phase to three-phase transformation with three transformers.

Fig. 4, *b*, shows another method of transforming phases with three transformers. In this method the magnetic fluxes are not modified, but they remain exactly the same as if each transformer were operating on a single-phase circuit, receiving a single-phase current in the primary and giving out a single-phase current in the secondary. A single polyphase unit or three single-phase transformers may be employed, the respective primaries and secondaries having common magnetic circuits.

The essence of the method employed here is that it requires no modification whatever of the action of the transformers used. In the three-phase system of supply the emfs of the primary coils differ by 120 deg. and the emfs of the secondary coils differ by the same number of degrees, there being no modification of the phase relations of the two sets of emfs when the three single-phase transformers are connected to give two-phase currents in two pairs of conductors joined to approximate selected points of the secondary coils. In other words, this method is based on the fact that the currents and emfs differing in phase relation may be compounded in exactly the same way that mechanical forces differing in direction are compounded, there being in each case a resultant dependent upon the magnitude and relation of the forces that are involved.

From the practical viewpoint the above-described groups of three-phase to two-phase methods are:

(1) *"T" or Scott Method.*—Two ordinary single-phase transformers or one ordinary and one special transformer connected in "T," but in no other way. (See Fig. 2, *a*.)

(2) *"T" or Scott-Steinmetz Method.*—Two ordinary single-phase or one ordinary and one special transformer connected in "T," but in no other way. (See Fig. 2, *b*.)

(3) *"Y" Two-Phase Method.*—Three ordinary single-phase transformers or one ordinary and one special transformer connected in "Y" to a three-phase supply; but never in delta.

(4) *"Delta" Two-Phase Taylor Method.*—Always three ordinary single-phase transformers and always connected in delta. (See Fig. 4, *b*.)

Method (4) has the three following main distinctions from methods (2) and (3): First, different apparatus is necessary to obtain equal results; second, distinct method of connecting the apparatus; third, different phase relations of the two-phase resultant voltages, prohibiting parallel operation with the others.

And, as regards the use of either (1), (2) or (3), when any one unit of the group becomes disabled it is impossible to operate and deliver polyphase currents, as can be done in the case of (4), which has the advantage of delivering three-phase and two-phase currents when any one unit becomes disabled by simply dropping back to the open delta or V connection, as at *c* in Fig. 4.

In an article on the Lauffen-Frankfort transmission system in the London *Electrician* of Sept. 18, 1891, communicated by Dr. Gisbert Kapp, there is described a system in which three-phase currents generated at Lauffen by three-phase transformers were transmitted to Frankfort, a distance of 110 miles, the three-phase currents being conveyed by three conductors such as are shown in Fig. 5.

At the receiving end (Frankfort) the secondary circuits of the three-phase transformers were connected so that a four-wire system was employed; thus in this early system use was made of the same method of transformation—that is, three-phase to two-phase or vice versa.

If the Lauffen-Frankfort plant, indicated at *a'* and *b'* of Fig. 5, be compared with the arrangements *a* and *b* of Fig. 3, it will be seen that the latter involve nothing in the way of transformation, transmission or distribution distinct from what was already in use other than the fact that one transformer has a greater or lesser number of turns or a different part of its winding connected to obtain

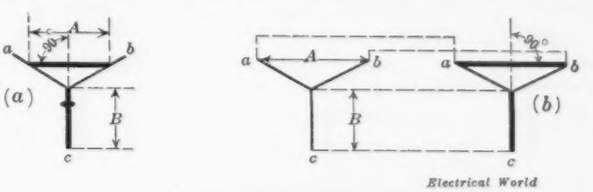


FIG. 6—USE OF TRANSFORMER TAPS

the two-phase relation. The same thing applies (if at all necessary) to the Lauffen-Frankfort plant, since if one transformer is connected as at *b* the remaining two half-coils must have the same ratio tap for flexibility and reliability of operation. (See Fig. 6.)

WILLIAM T. TAYLOR.

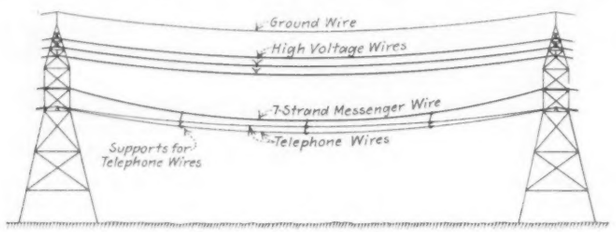
Richmond, Surrey, England.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Long-Span Construction for Telephone Lines on Transmission Towers

A power transmission company in northern New York State has adopted a type of construction for the telephone circuit used in connection with its high-tension lines which does away with the difficulties usually encountered in long-span telephone construction. As the towers were spaced about 350 ft. apart, the tensile strength of the light copper



LONG-SPAN CONSTRUCTION FOR TELEPHONE LINES

telephone wire prohibited the dispatch line from being placed on the main towers without some intermediate support. Accordingly a light seven-strand messenger cable was strung below the high-potential wires, and upon this supporting steel cable are hung iron brackets such as are sometimes used on long-distance telephone lines for making phantom transpositions. Three of these supporting brackets in each tower span divided the weight of the telephone spans into four parts, so that it is readily supported and the danger of trouble on the telephone line due to accidental short-circuits caused by the wires swinging together is reduced to a minimum. The high-tension lines and the telephone wires are placed in separate vertical planes in order to lessen the danger of contact should one of the power wires fall.

Pumping and Heating of Oil Fuel

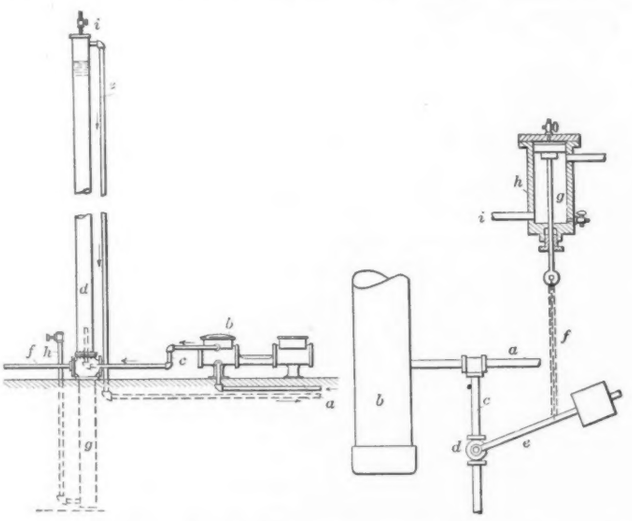
By R. T. Strohm

In every oil-fuel installation there must be pumps to draw the oil from the storage tanks and deliver it to the burners under pressure. The storage tanks are invariably located underground and therefore at a lower level than the burners. The primary purpose of the pumps, consequently, is to lift the oil from the tanks. The heavy oils employed for fuel are usually too viscous and sluggish to flow freely of their own accord, and so the pumps fulfil the second object of supplying the oil under pressure. In this way the maximum amount of oil supplied may be regulated to suit the demand, regardless of the condition or quality of the oil.

One of the simplest methods of insuring a steady pressure of oil at the burners is to use a standpipe, as shown in Fig. 1. The oil is drawn from the storage tank through the suction pipe *a* by the pump *b* and is discharged through the pipe *c* into the standpipe *d*. This is made of 4-in. pipe and is of sufficient height to give the desired pressure of oil at the burners. An overflow pipe *e* one or two sizes larger than the discharge pipe *c* is connected near the top and is carried back to the storage tank. The speed of the pump is regulated so that the amount of oil delivered is somewhat in excess of that used by the burners. As a result, the standpipe is constantly kept full to the level of the overflow. The excess of oil simply flows back to the storage tank through the pipe *e*, and as the height of the oil column in the standpipe remains unchanged, the pressure in the oil main *f*, leading to the burners, remains constant. The pipe *g* is an extension of the standpipe that serves as a trap for water and sediment contained in the oil. These impurities, being heavier than the oil, fall to the bottom of the pipe *g* and may be blown out at intervals through the pipe *h*. A vent cock *i* is added at the top of the standpipe to allow the release of gas that enters with the oil and collects above the column.

The object of maintaining a uniform pressure of oil is to insure proper working of the burners and economical combustion. If the pressure were allowed to vary rapidly, the rate of flow of the oil would be changed and the burners would work erratically. Not only that, but the ratio of air to oil would be altered continually and inefficient combustion would result. There seems to be no fixed value for the pressure at which the oil is delivered to the burners. In an extended series of tests made by the Bureau of Steam Engineering of the United States Navy, the pressure varied from 9 lb. to 160 lb. per sq. in., depending on the type of burner, the quality of the oil and the nature of the installation. In the greater number of cases, however, the pressure lies within the limits of 10 lb. and 50 lb. per sq. in.

The required height of the column of oil in the standpipe to produce a desired pressure may easily be calculated,



FIGS. 1 AND 2—STANDPIPE USED TO SECURE STEADY OIL PRESSURE AND SAFETY DEVICE FOR DRAINING STANDPIPE

if the specific gravity of the oil is known, by the use of the formula $H = 2.304\ P \div G$, in which H is the height of oil column, in feet; P, the required oil pressure, in pounds per square inch, and G, the specific gravity of oil used.

The height H of the oil column thus found is the vertical distance between the level of the burner orifices and the level of the overflow at the top of the standpipe. For

example, if a pressure of 15 lb. per sq. in. is required and the oil has a specific gravity of 0.96, the height of the oil column must be

$$H = 2.304 \times 15 \div 0.96 = 36 \text{ ft.}$$

With the standpipe arrangement, a considerable quantity is stored at a point above the level of the burner outlets; consequently, if a burner should inadvertently be left open when out of service, the furnace would be flooded with oil. Because of this, some insurance companies refuse to insure plants in which oil is fed by gravity.

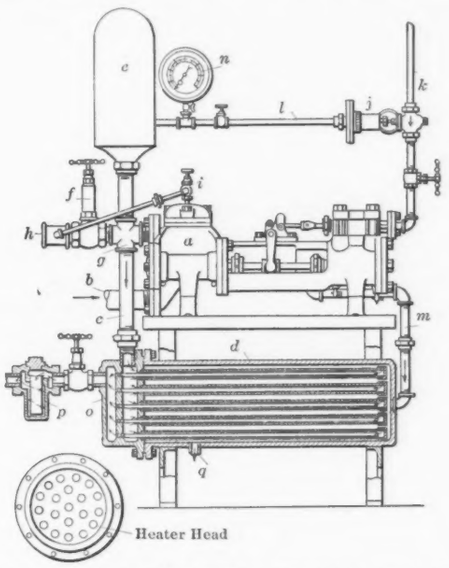


FIG. 3—METHOD OF OBTAINING UNIFORM OIL PRESSURE

The danger of flooding with oil may be overcome by using a safety device, so that when there is no steam pressure for atomizing, the oil in the standpipe will be returned to the storage tank. An arrangement of this kind is shown in Fig. 2. The pipe *a*, leading from the standpipe to the burners, has a branch *c*, in which is fitted a cock *d* that is opened when the weighted lever *e* is allowed to fall. This lever is connected by a chain *f* to the piston rod *g* of a small piston in the cylinder *h*. A steam pipe from the boiler is attached at *i* and a pipe *j* leads to the oil pump, so that the steam supply to the pump must pass through the cylinder *h*. The pressure of the steam forces the piston to the upper end of the cylinder and holds it there, thus keeping the cock *d* closed as long as there is sufficient pressure in the boiler. But when the steam pressure falls below that required to run the pump and atomize the oil, the lever *e* drops and opens the cock *d*, thus allowing all the oil in the standpipe to run back into the storage tank.

Another way of maintaining a uniform pressure of oil is to employ a duplex feed-pump and to put on the discharge pipe a relief valve set to open when the desired pressure is exceeded. A side view of such an apparatus is shown in Fig. 3 in connection with a longitudinal section of an oil heater. The duplex pump *a* has a suction pipe *b* that leads direct from the storage tank. The discharge from both sides of the pump is led through the pipe *c* to the heater *d*. The air chamber *e* and the relief valve *f* are in communication with the discharge pipe through the cross *g*. The air chamber cushions the intermittent discharges of oil and prevents shocks. The relief valve, which is merely a spring-loaded valve, is set to the pressure desired at the oil burners. As soon as the pump supplies too much oil, and this pressure is exceeded, the valve rises and the excess of oil is returned to the storage tank by a pipe connected at *h*. Two small pipes lead from the tops of the discharge chambers to the overflow pipe and are fitted with valves *i* to allow any gas collecting in those chambers to be removed.

The speed of the pump is regulated automatically by a governor *j* on the steam line *k* to the pump. The governor consists of a flexible diaphragm directly connected to a throttle valve in the steam line. One side of the diaphragm is acted on by the pressure of the oil, which is transmitted through the small pipe *l*, and on the other side by a spring that can be adjusted as desired. When the oil pressure rises too high, the pressure of oil on the diaphragm overcomes the spring pressure and closes the throttle valve somewhat. This reduces the steam supply to the pump and lessens its speed. The oil pressure then decreases and the spring forces the diaphragm back again, opening the valve and admitting more steam. By adjusting the tension of the spring, a very uniform speed of the pump may be obtained. The exhaust from the steam ends of the pump is led through the pipe *m* to the heater, where it is used to heat the oil. A pressure gage is attached at *n* to show the pressure of the oil on the discharge side of the pump.

The object of the heater is to increase the temperature of the oil and thereby decrease its viscosity. The heavy crude oils are very sluggish, and in this condition they are not easily atomized. If their temperature is low, their rate of flow is still further reduced. Therefore, a heater is inserted in the oil system to render the oil more fluid and easy to break up into a spray. In the illustration the heater is placed between the discharge of the pump and the burners. It consists of a cylindrical outer shell *d* into which the exhaust steam is conducted by the pipe *m*. The head *o* of the heater has two compartments, and into it are screwed two sets of tubes. The larger tubes are closed at one end and fit over the smaller ones, which are open at both ends. The oil from the pump flows into the inner compartment in the head, thence into the larger tubes, around the smaller ones, and finally back through the inside tubes to the outer compartment, from which it passes to the burners through the strainer *p*. The water and uncondensed steam are drawn out of the shell at *q*.

The form of heater shown in Fig. 3 is efficient, because the oil is divided into a number of thin films that pass between the outer and inner tubes while the heat is transmitted through the outer tubes. A much simpler form, and one that is less expensive, is shown in Fig. 4. It consists of two cast-iron cylinders *a* and *b*, one inside the other.

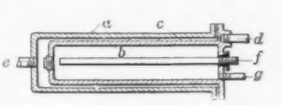


FIG. 4—SIMPLE OIL HEATER

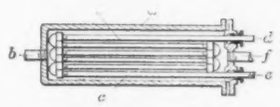


FIG. 5—STEAM COIL OIL HEATER

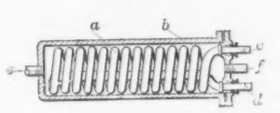


FIG. 6—STEAM COIL OIL HEATER

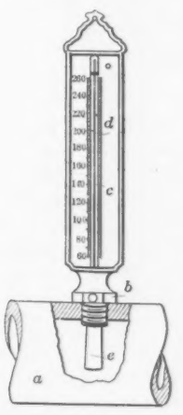


FIG. 7—ARRANGEMENT FOR OBTAINING OIL TEMPERATURE

The narrow space *c* between the inner and outer shells is filled with the oil to be heated, which flows in at *d* and out at *e*. Steam is led into the inside cylinder through a pipe *f*, and the water and waste steam are removed at *g*. This form is not extremely efficient, because the cast-iron walls are thick and the oil is not divided into very thin sheets.

Another way of arranging the coils in the heater is

shown in Fig. 5. The oil flows into the heater shell *a* through the pipe *b* and surrounds the pipe coils *c*, which are made up of straight pipes joined by return bends. Steam is admitted into the top coil through the connection at *d*, and the water is drained out at *e*. The oil flows through the heater from *b* to *f*.

The heater shown in Fig. 5 is more efficient than that in Fig. 4, but the one shown in Fig. 6 gives better heating than either, because the coil *a* that carries the steam has a greater amount of heating surface exposed to the oil. It is made in a continuous coil that fits closely inside the shell *b*. Steam enters at *c* and the condensation escapes at *d*. The oil enters at *e* and is discharged at *f*.

The corrugated film heater shown in Fig. 8 is designed with a view to obtaining a very high efficiency. It consists of two spirally corrugated copper tubes *a* and *b*. These fit very closely, leaving only a thin space between them, and oil is led into this space through the inlet *c*. It flows upward between the two corrugated tubes and passes out at *d*. Steam is admitted through the pipe *e* and flows directly to the interior *f* of the tube *b*. At the same time a branch pipe *g* admits steam to the chamber *h* surrounding the outer tube and formed by the inclosing cylindrical shell *i*. The oil film is thus heated by the transmission of heat inward through the outer tube and outward through the inner tube. The steam and oil flow in opposite directions, so that the warmest oil meets the steam entering the heater. This countercurrent adds to the efficiency of operation. The drain pipe *j* serves to remove all condensation from the steam chambers, and the shell is protected by a non-conducting covering *k* that reduces the loss of heat to the surrounding air. The tubes may be removed for cleaning; or the plugs *l* and *m* may be taken out and live steam may be blown through between the tubes. This will quickly and thoroughly clean out all sediment and tarry deposits.

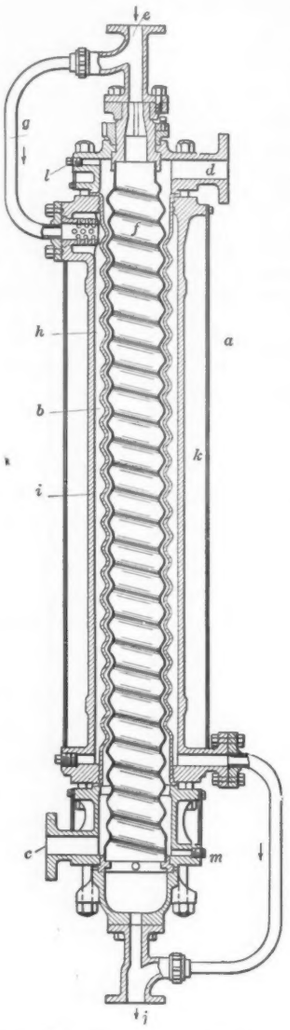


FIG. 8—CORRUGATED FILM OIL HEATER

As the heater is placed between the pump and the burners, it is subjected to the full pressure of the oil, and it should be tested to see that it is capable of withstanding the maximum pressure that may be put upon it. Some makers guarantee their heaters for a pressure of 200 lb. per sq. in., which is well above the point that will be reached in ordinary work. The joints of the steam coils or of the tubes fitted in the head of the heater should be absolutely tight, so that no water can leak into the oil supply. Also, the pipes and tubes should be arranged so that they can expand and contract freely, without springing joints open and causing leaks.

Heating of the oil between the pump and the burners is done to make atomization easier. In some cases, however, it is necessary to heat the oil in the storage tank so that it will flow readily to the pump. This is particularly true of installations in cold climates. There are crude oils that at temperatures of from 30 to 40 deg. Fahr. become so sluggish that they cannot be drawn to the pump, and they must be heated sufficiently to cause them to flow. It is neither necessary nor advisable to heat the entire bulk of oil in the storage tank. A steam coil can be located around the lower end of the suction pipe. This will heat the oil in the immediate neighborhood of the entrance to the pipe and enable it to be drawn up. In any case, the heating must not be carried to a point at which the oil will begin to decompose, that is, break up into its constituent hydrocarbons. The temperature at which decomposition occurs varies for oils of different qualities and from different localities, but usually it does not exceed 180 deg. Fahr.

The temperature of the oil may be observed by a thermometer placed in a mercury cup in the oil line leading to the burners, as shown in Fig. 7. The pipe *a* conveys the oil to the burners, and into it is screwed a fitting *b* that carries the thermometer tube *c* and the scale *d*. At the bottom is a long cup *e* filled with mercury, in which the lower end of the tube *c* rests. The heat of the oil flowing through the pipe is thus transmitted to the tube and the temperature is registered on the scale.

If the plant is of such character that even a brief shutdown would entail great loss or inconvenience, the oil pump should be duplicated, so that one set of pumps will be in reserve in case the other set fails. This can be arranged by using a system of cross-overs in the piping. Also, it is an excellent plan to have the entire system of oil pipes connected so that live steam may be blown through it to clean it of dirt and tarry matter adhering to it.

Energy Consumption of Electric Vehicles

Can you give data on the kilowatt-hour consumption per mile for electric trucks of various sizes? I am seeking figures in terms of energy actually supplied through the charging switchboard; in other words, the meter reading likely to be registered and for which the customer has to pay. M. N. O.

Obviously the kilowatt-hour consumption per mile of travel will depend upon the type and size of the vehicle, number of miles traveled, conditions of charging and use, character of roads, whether paved or hilly, and numerous other factors. A definite figure cannot therefore be given, but following are actual reports received from a number of electric-truck users in response to inquiries recently sent out from this office:

	Kw-hr. per Mile
1000-lb. wagon, lead battery	0.69
4000-lb. truck, lead battery	1.20
1000-lb. wagon, nickel-iron battery	0.85
500-lb. roadster, nickel-iron	0.70
750-lb. runabout, nickel-iron	0.50
750-lb. roadster, lead cells	0.50
4000-lb. truck, nickel-iron cells	2.25
3000-lb. truck, lead cells	1.00
1000-lb. truck, lead cells	0.54
Average of fifteen vehicles, 750 lb. to 4000 lb., lead cells	0.80
Average of five vehicles, 750 lb. to 3000 lb., lead and nickel-iron	0.60 to 0.90
Average of four cars, 700 lb. to 7000 lb., lead cells	2.80
Average of four cars, 700 lb. to 2000 lb., lead cells, approximately	0.50
Average of thirteen cars, 750 lb. to 4000 lb., lead and nickel-iron.	1.80
Average of 25 cars, 500 lb. to 8000 lb., lead cells	0.38

These figures are in no sense comparative, for they represent widely different conditions in remote parts of the country, but they afford some practical estimate of the operating results which are being accomplished to-day. Hilly roads and poorly paved streets are among the factors which notably increase kilowatt-hour consumption, as the higher figures in the list above were invariably taken from vicinities where the cars were required to climb grades.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Electrolytic Rectifier.—KARL SIEGL.—The disadvantage of the ordinary electrolytic rectifier is the formation of little sparks all over the surface of the aluminum cathode. This results in the heating of the cathode and of the electrolyte and in a considerable reduction of the capacity of the rectifier. To overcome this difficulty the author uses a hollow aluminum cathode, the cooling water being continually passed through its interior. Its effect is so beneficial that a cooled cell will stand a current ten times as large as an uncooled cell. In order to utilize both half waves of the alternating current four cells must be connected in the well-known manner and the cooling water is passed successively through the different cathodes. To prevent shunts on that account, the aluminum cathode is made in the form of an aluminum tube with a lead tube in its inside, the aluminum tube and the lead tube being insulated from each other by paraffine oil. The cooling water passes through the lead tube.—*Elek. Zeit.*, Aug. 21, 1913.

Improving the Power-Factor.—GISBERT KAPP.—An article illustrated by diagrams in which the author discusses the economical value of methods for improving the power factor. The author then explains theoretically the operation of the "vibrator" (which has already been described in detail in the *Digest*) and shows how the circular diagram is changed by the use of a vibrator. Finally the results of tests and practice are given.—*Elek. Zeit.*, Aug. 14, 1913.

Lamps and Lighting

Photometer for the Measurement of Light Distribution.—M. SCHANZER.—An illustrated description of a new photometer of K. Satori for the measurement of light distribution which may be described as a modification of the photometers of Martens and Brodhun. The new photometer shown in Fig. 1 connects the movable arm with the photometer. At one end of the bench two rings are mounted on a stand; these rings carry a tube, which can revolve within the rings on roller bearings. The end of the tube facing the photometer carries an achromatic objective, the focus of which lies immediately above the zero mark of the bench. At the other end is a collimator lens with mirror. An arm 1.5 m long is mounted on the tube and carries a second mirror, as shown; a counterweight is provided in the usual way. The light is received by the collimator lens from the mirrors. The broken line which represents the optical distance of the source of the light from the collimator lens is equal to the focal strength of the lens, and the divergent ray that falls upon it is, therefore, converted into a parallel ray. By means of the objective a real image of the source of light is formed above the zero of the photometer scale. A shield prevents the direct access of the light to the photometer. Thus all the lenses are fixed instead of being carried on the rotary arm, and this allows the use of large heavy lenses, comparatively speaking, with short focal lengths, which tends to increase the amount of light received on the photometer. Thus the real image of the source of light always appears above the zero of the photometer and is available as a measure of the illumination in the given direction in which the arm happens to be placed. The arm is then moved into different positions, and readings are taken by adjusting the position of the standard lamp at the other end of the bench. There is no need in this case to measure the distance from the source of light to the photometer screen. Scales are mounted on the instrument for reading the precise position of the rotary arm. For sources of light of considerable volume a matte screen is provided. Thus the mirror on the rotary arm is reversible, the back of it being a matte reflecting surface. In this case the photometer screen is so adjusted that the image of the diffused light on the matte surface falls directly upon the screen. The final adjustment, therefore, is not made by moving the photometer but by altering the aperture of the lens, which is provided with an iris diaphragm for the purpose. This diaphragm is provided with a scale.

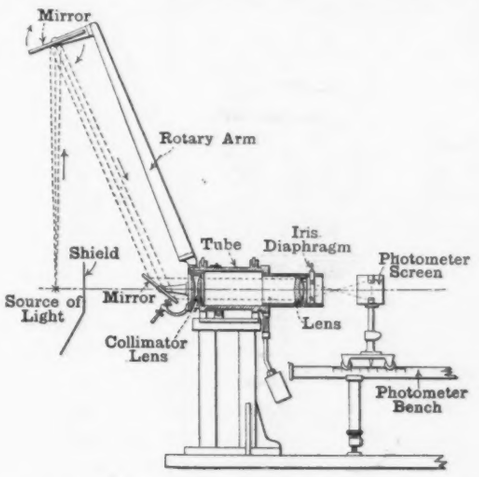


FIG. 1—PHOTOMETER FOR MEASURING LIGHT DISTRIBUTION

The reading on the scale multiplied by the candle-power of the standard lamp gives the reading required. For the lowest part of the scale the plain reflector is, of course, used on the rotary arm. The upper limit of the capacity of the instrument is very high, seeing that the photometer screen can be adjusted in position, and in addition to this, if the source of light is very strong, the iris-diaphragm method is also available. The new photometer, therefore, has great range in the measurement of the distribution of light and can also be used in connection with flicker methods. There is no need to measure distances in any case, and the results are obtained by taking the readings on the various scales provided with the instrument.—*Elek. u. Masch.* (Vienna), May 25, 1913; translated in abstract in London *Electrician*, Aug. 29, 1913.

Generation, Transmission and Distribution

Explosion of a Turbo-Generator.—An illustrated article on the explosion of a 2500-kva turbo-generator in the lighting station of Trieste. It seems that the speed of the generator in the instant of the explosion was 2500 or 2600; that is, at least, twice the normal speed. Firms which build turbo-generators guarantee in general their machines only for an increase of speed of 15 to 20 per cent. If machines stand an increase of speed of 50 per cent, they are considered perfectly reliable. "The generator in this case was damaged only at double the normal speed, so that this rare accident is really a brilliant proof of the perfect

safety of the design."—*Elek. u. Masch.* (Vienna), Aug. 10, 1913.

Ventilation of Steam-Turbine Engine Rooms.—Edgar Knowlton.—The gradual growth of the output capacity of those power stations which have replaced some or all of their reciprocating engines by high-speed turbines without increasing the size of their engine rooms has, in some cases, reached such a degree that the original ventilating systems have been found to be inadequate, resulting in discomfort to the attendants and abnormal operating temperatures of the electrical apparatus. This article cites the growth of several typical plants and shows how imperative it is that special attention be given to the ventilation of the engine room. It describes the most approved methods of supplying air to, and conducting it from, both vertical and horizontal turbines; discusses and furnishes formulas to apply in the design of the air ducts to accomplish this purpose, and states the quantity of air required. The operation of a humidifier is described, and its cost per kilowatt of station capacity is given. Its effects on the specific heat of the ventilating air, on its cleanliness and on its temperature are explained. The article concludes with recommendations for the improvement of ventilation of present existing stations and the designs of future ones. —*Gen. Elec. Review,* September, 1913.

Traction

Electric Traction on Trunk Railroads.—W. Usbeck.—A lecture given before the annual meeting of the German Association of Electrical Engineers. The author gave a brief historical sketch and discussed the different systems of electric traction on trunk railroads and their advantages over steam traction. The chief economical advantage is the concentration of the generation of energy in large power plants with the rational utilization of the natural sources of energy available in form of water-powers, bituminous coal fields and peat deposits. With cheap electric power thus becoming available, an economical electric operation of the main railroads becomes possible.—*Elek. Zeit.,* Aug. 21, 1913.

Installations, Systems and Appliances

Condenser-Type Outlet Terminal.—C. Fortescue and J. E. Mateer.—An illustrated article on the condenser-type outlet terminal. The first author discusses the theory of design, the second author construction and application.—*Elec. Journal,* August, 1913.

Paris.—T. Pausert.—An illustrated article on the electricity supply of Paris. The Parisian Company of Distribution of Electricity is building at present two central stations of 50,000 kw and 25,000 kw respectively. These are called the Northern station and the Southwestern station. Both produce two-phase currents at 12,300 volts with a frequency of 42 cycles per second. The Northern station has eight turbo-generators, each of 10,000 kw to 15,000 kw. The Southwestern station has three turbo-generators.—*La Revue Elec.,* Aug. 15, 1913.

Electric Equipment of Battleships.—H. A. Hornor.—A Franklin Institute paper on the modern equipment of battleships. The author suggests certain modifications to the present equipment, based on land usages and their adaptation for marine purposes. The use of alternating current on shipboard is proposed.—*Journal Franklin Inst.,* August, 1913.

Automatic Pressure Regulators.—R. L. Morrison.—The conclusion of his illustrated article on various types of automatic pressure regulators. In the present instalment the Thury and Brown-Boveri regulators are described.—London *Electrician,* Aug. 29, 1913.

Electrophysics and Magnetism

Electric Resistance of Pure Metals at Helium Temperatures.—H. Kamerlingh Onnes.—A further account of his very careful experimental investigations on the potential difference which is necessary to pass an electric current through a mercury thread at a temperature of 4.19 deg. Kelvin. The surprising phenomena may be summed up as follows: At every temperature below 4.18 deg. Kelvin for a mercury thread inclosed in a glass capillary tube a "threshold value" of the current can be given, such that at the crossing of the threshold value the electricity goes through without any perceptible potential difference at the extremities of the thread being necessary. It appears, therefore, that the thread has no resistance, and for the residual resistance which it might possess a higher limit can be given determined by the smallest potential difference which could be established in the experiments (here 0.03×10^{-6} volt) and the threshold value of the current. At a lower temperature the threshold value becomes higher, and thus the highest limit for the possible residual resistance can be pushed further back. As soon as the current density rises above the threshold value a potential difference appears which increases more rapidly than the current. This seemed at first to be about proportional to the square of the excess current above the initial value, but as a matter of fact at smaller excess values it increases less and at greater excess values much more rapidly. The experimental arrangement and various modifications of the same are described in some detail, and the view is expressed that the disappearance of the ordinary mercury resistance at 4.19 deg. Kelvin occurs quite suddenly, and in a thread that has been cooled to below that temperature, as soon as the threshold value of the current density is exceeded, somewhere heating occurs which carries the thread at that place to above that temperature, at first over a scarcely perceptible length but at higher currents over a rapidly increasing resistance, by which ordinary resistance is generated in this part of the wire. With these larger currents the thread then reaches a state in which there is no uncertainty; it assumes over its entire length the new temperature equilibrium of a thread carrying a current, which equilibrium is determined above the vanishing point in the usual way. It seems that small additions of other metals to mercury do not change the phenomena.—London *Electrician,* Aug. 29, 1913.

Electrochemistry and Batteries

Action of the Magnetic Field Upon Electric Discharge Through Gas.—L. T. Moore and G. J. Mauchly.—An account of an experimental investigation from which the authors conclude that the function of the magnetic field is to modify the discharge rather than to create a new type of rays such as has been proposed by Villard and Righi. The main action of the magnetic field is to reduce greatly the potential drop at the cathode and to force charged particles in the tube to move away from the cathode in helical paths. Owing to their greater mobility and longer free path, this action is more pronounced on electrons than on positive gaseous ions.—*Philos. Magazine,* August, 1913.

Great Falls Electrolytic Copper Refinery.—Willis T. Burns.—A long and profusely illustrated paper read before the American Institute of Mining Engineers on the electrolytic copper refinery in Great Falls, Mont., which is unique in two respects. The current density is at least 60 per cent higher than that regularly employed elsewhere and the anodes treated are the direct product of the converter rather than of the reverberatory furnace.—*Metall. and Chem. Eng'ing,* September, 1913.

Electric Steel Refining.—O. Frick.—An abstract of a paper read before the (British) Iron and Steel Institute on electric steel refining in an induction furnace. The results given in this paper are based on results obtained in the Frick furnaces at Krupp's works in Essen, and "serve to show that whatever the history and present position of the electric furnace in the steel industry, its future possibilities are such that it may be anticipated that a time will come when half the steel produced will have been passed

through the electric furnace."—London *Electrician*, Sept. 5, 1913.

Units, Measurements, and Instruments

Electrical Methods for Comparing Thermal Conductivities.—WILLIAM EVES, 3D.—An illustrated article on a method of Mr. E. F. Northrup for comparing thermal conductivities. The method was used by the author for comparing the thermal conductivities of commercial impregnating compounds such as are used for the field coils of electrical machines. It consists in the heating of two coils of copper wire, identical in every respect—namely, size, shape, electrical resistance and in insulation—except for the compounds with which they are impregnated and of which the conductivities are to be compared. This heating is done by passing such currents through them as will cause them to become each equal in resistance to some set resistance which is previously calculated and the magnitude of which determines the mean temperature of the coils. Sufficient time must be taken to allow a steady state of heat flow to be reached, in order not to obtain false results. If this steady state has been reached and if the external temperatures are maintained equal, the total energy input into each coil will be equal to the heat flow and therefore to the energy dissipated by the coil. Since the coils are identical in size and shape, the thermal conductivities of the wire, insulation and impregnating compounds of the coils will be proportional to the amount of energy input, since the material of greater conductivity allows proportionately greater energy to be conducted through it. The watts dissipated from the two coils will be: $W_1 = C_1^2 R_t$ in coil A and $W_2 = C_2^2 R_t$ in coil B, where R_t equals the resistance of coils A and B at the higher temperature t, and C_1 and C_2 are currents passing through A and B respectively. Therefore $k_a/k_b = W_1/W_2$

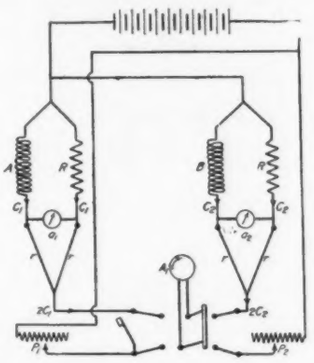


FIG. 2—CONNECTIONS FOR COMPARING THERMAL CONDUCTIVITIES

$= C_1^2/C_2^2$, where k_a is the conductivity of coil A and k_b is the conductivity of coil B. Hence it follows that for equal mean internal temperatures steadily maintained for both coils their thermal conductivities will be in direct ratio to the squares of the currents passed through each. The arrangement of the experiment is shown in Fig. 2. A and B are two identical double-cotton copper wires, but impregnated with different insulating compounds. The apparatus consists of two Wheatstone bridges, in which the heating current passes through the bridges. Coils R R are adjustable resistances of wire of very low and equal, or zero, temperature coefficient, which are set to the calculated resistance which the coils A and B will have at the temperature at which it is desired to take the measurement. Resistances r, r, r, r are ratio resistances, equal in value. a_1 and a_2 are small portable galvanometers, which were found sufficiently sensitive for this method. Millivoltmeters can be used. A is an ammeter connected through a double-throw switch and short-circuiting switches, and of suitable range to measure the total currents passing through the bridges, which are each twice the currents flowing through the coils A and B, or R R, since the arms of the bridges are equal in resistance. p_1 and p_2 are variable rheostats of any rough type for adjusting the impressed voltage. Current was passed through the bridges until the detectors showed that the mean internal temperatures of the coils A and B had risen until their resistances were equal to the set resistances R R. The results obtained in comparison of four insulating compounds are given in a table and show the high accuracy of the method. The apparatus may be set up in a small space and is simple and the method is commercially practical.—*Metall. and Chem. Eng'ing*, September, 1913.

Electrolytic Iron for Construction of Instruments.—MOELLINGER.—A communication with reference to the recent article by Breslauer on the use of pure electrolytic iron for the construction of dynamo-electric machines and transformers. The present writer emphasizes that the low remanence and hysteresis and the high permeability of the electrolytic iron can be made use of also in measuring instruments, especially in electricity meters. Meters can be made far more efficient by electrolytic iron. Such iron can also be used for the cores of measuring transformers and for the cores and armatures of overload circuit-breakers and relays.—*Elek. Zeit.*, Aug. 14, 1913.

Testing.—Continuations of the long illustrated serial on shop testing of electrical apparatus. In the present instalments direct-current shunt and compound motors and industrial series and heavily compounded motors are taken up.—*Elec. Journal*, July and August, 1913.

Telegraphy, Telephony and Signals

Traffic Distribution in Manual Telephone Exchanges.—J. BAUMANN.—An illustrated article in which the necessity of improving telephone service by equalizing the operator's load is demonstrated. The selector-switch system of automatic traffic distribution is described, and its immediate applicability to any existing central-battery telephone exchange is shown.—London *Electrician*, Aug. 29, 1913.

Telephone Stations of the World.—W. H. GUNSTON.—A statistical article on the telephone development of the world and especially in the great cities up to the beginning of 1912. The paper contains six interesting tables.—London *Electrician*, Sept. 5, 1913.

Book Review

TELEPHONE ERECTION AND MAINTENANCE. By Herbert G. White. London: S. Rentell & Company. 129 pages, 12 illus., 36 diagrams. Price, 50 cents.

This little publication is in reality a handbook for the contractor and wireman which has been written for the purpose of explaining the principles underlying domestic telephones of the type met with in contracting experience. The work is divided into eight chapters, which treat of house-bell circuits, battery-ringing telephones, magneto-call telephones, intercommunication systems, secret intercommunication systems, switchboard systems, instrument erection, line construction, testing and fault finding, each of which covers its subject in a thorough and interesting manner. Illustrations and simplified wiring diagrams are used effectively for supplementing the descriptive text. An idea of the thoroughness with which the work of the author has been done may be gained from the statement that every point which might confront the contractors from pole-hole digging to switchboard wiring has been carefully and fully covered. The author's twenty-one years' experience in the telephone field, about equally divided between manufacturing and contracting, makes itself felt in the character of the book.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Compound for Attaching Brush Leads to Brushes

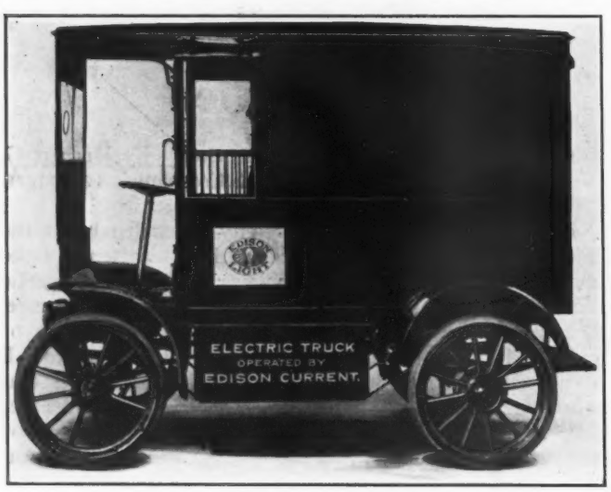
For the operating engineer who has need of a means of attaching the flexible copper leads to motor or generator brushes at short notice the Nungesser Carbon & Battery Company, Cleveland, Ohio, has recently put upon the market a copper compound for facilitating the work of making reliable joints of this kind. The compound is sold in a powdered form which may be carried in a small bottle or a box. A hole drilled in the top of the brush to be repaired receives the brush lead and the remaining space is filled with the compound. A hammer and any other tool small enough are used to tamp in the powdered product much after the fashion used by the dentist in placing a gold filling.

It is maintained by the manufacturers that the resulting joint gives satisfaction both as to lasting qualities and current-carrying capacity. It is also stated that the compound may be used with carbon, graphite or metal brushes with equal success.

Central-Station Service Car

Two electric-service wagons of the type illustrated herewith were shipped recently to the Edison Electric Illuminating Company of Boston by the Waverley Company of Indianapolis, manufacturer. This serviceable car weighs 3500 lb. and will carry a load of 1000 lb. without counting the weight of the driver. Its maximum speed is 15 miles an hour and it is manufactured to run 60 miles on one battery charge.

Sixty cells of type A4 Edison storage battery, in an underslung compartment, supply electricity to a series-wound

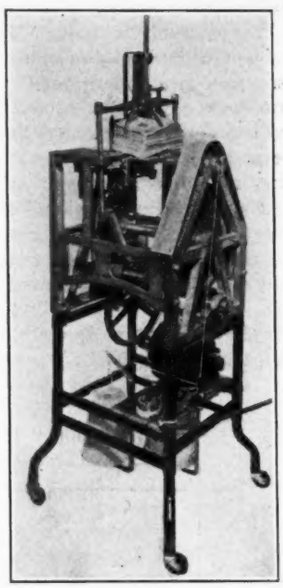


ELECTRIC-SERVICE WAGON

motor, mounted on the steel frame of the car. Shaft drive is used, and all driving gear is inclosed. The braking equipment is of the dual-expansion hub type, which places both brakes on the rear hubs, avoiding braking through any driving mechanism. The vehicle has a wheelbase of 90 in. and a tread of 56 in. The wheels are 34 in. in diameter and are fitted with solid cushion tires.

Motor-Driven Package-Tying Machine

As letters are sorted in city post offices they are tied up by towns into packages, each marked with its destination. A given piece of mail between post-box and carrier's bag may thus form part of several packages, each of which has now to be tied by hand. A clerk can tie up about six such packages a minute, but the motor-driven machine illustrated herewith is capable of handling thirty-two per minute, tying each package firmly with a double-loop, hard knot, which is proof against slipping. A 0.125-hp Westinghouse motor drives the device, first applying compression to hold the letters in place while being fastened. A lever actuated by the operator's wrist controls the starting of the machine while the hands continue to hold the package in position. Fifteen hundred packages an hour have been tied by one of these machines, the piles ranging from five or six letters to seventy-five in each. As soon as they are tied the packages are automatically swept into a basket at the side, and the machine is ready for another operation. No cord is wasted by the machine, a saving of 40 per cent over the amount required for hand tying being thus effected. Sample machines are now on test by the Post Office Department at New York and Chicago. The machine has, of course, numerous other applications in the tying of packages of all kinds besides that above described. It is the invention of Mr. B. H. Bunn and is manufactured by the Automatic Package Tier Company, 9970 Charles Street, Chicago.



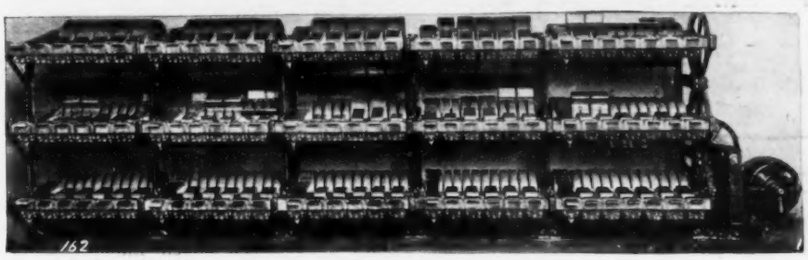
AUTOMATIC PACKAGE TIER

Central-Station Sign at Washington, D. C.

Manufacturers of electric signs are always striving to produce new displays to attract the attention of passers-by. One such novel sign completed recently for the Potomac Electric Power Company, of Washington, D. C., will be

used to advertise central-station energy. It represents four zouaves going through the military manual, with guns successively at the position of "shoulder arms," "present arms," "parade rest," etc. After the drill is completed the display changes to the central-station advertisement, which reads: "Use Electric Light. Potomac Electric Co."

The sign measures 40 ft. long and 40 ft. wide, being



MAMMOTH-FLASHER WHICH OPERATES SIGN HAVING 118 CONTACTS

supported on a frame made of angle irons arranged in the shape of a truss. The frame is supported on 30-in. I-beams, which are in turn carried on the walls of the building. Each zouave figure is 30 ft. tall and measures 9 ft. across the chest. Five thousand incandescent lamps are used on the sign and 20,000 ft. of wire connects them with the flasher. The latter device, illustrated herewith, was built by the Reynolds Electric Flasher Manufacturing Company, Chicago. Color effects are produced by the use of Reco color hoods. Besides its complication in construction, the flasher mechanism is of unusual size. It is built in three tiers placed one above the other. One hundred and eighteen contacts are required to produce the effects described. The sign was manufactured by the Valentine Electric Sign Company, Atlantic City, N. J.

International Refrigeration Exposition

In connection with the third International Congress of Refrigeration an interesting exposition was opened at the International Amphitheater in Chicago on Sept. 17, the date of closing being Oct. 1. The principal feature is a mammoth glass-walled refrigerator containing a large display of refrigerated foods of many kinds, the exhibits being assembled by the United States Department of Agriculture. Refrigeration for this building and for other refrigerated exhibits is furnished from a service plant consisting of compressors of the Frick, Vilter Manufacturing, York Manufacturing, Larsen and Baker Ice Machine companies belted to electric motors. Indeed, all operating exhibits are electrically driven, Westinghouse, Wagner, Century and other motors being used for this purpose.

A liberal display is made of frost-covered piping used for decorative features, railings around exhibits and lettering. These snowy outlines present a striking appearance and show the effectiveness of refrigeration at once.

"Electric Refrigeration" is the sign displayed at the booth of the Commonwealth Edison Company, which distributes literature and exhibits photographs of the nine ice-making plants in Chicago operated by central-station electric energy. Another electrical exhibitor is the Westinghouse Electric & Manufacturing Company, which has on display a number of alternating-current and direct-current motors and automatic starters. The Triumph Ice Machine Company, of Cincinnati, has in its booth direct-current and alternating-current motors made by the Triumph Electric Company.

In the exhibit of the Carbondale Machine Company, Carbondale, Pa., is shown an evaporator furnishing steam for an engine driving an electric generator. The engine exhaust operates a Carbondale by-product refrigerating machine, producing ice and refrigeration. The Baker Ice Machine Company shows a small raw-water ice-making plant complete. The Huetteman & Cramer Company, of Detroit, has also a complete raw-water ice plant in operation. The Vilter Manufacturing Company, Milwaukee, shows one of the largest ammonia compressors in the exposition, its rating being 125 tons. The York Manufacturing Company, of York, Pa., has a large and well-arranged exhibit of its various stock machines.

Some interesting electric instruments made in Germany are shown by the Hanovia Chemical & Manufacturing Company, of Newark, N. J. These include, among others, resistance thermometers for long-distance measurement of temperature, and telehygrometers, or instruments for testing the humidity of the air at a distance by electrical means. Other exhibits in which the electrical visitor may be interested are those of the American Steam Pump Company, motor-driven pumps and compressors; De La Vergne Machine Company, crude-oil engine; Draeger Oxygen Apparatus Company, pulmotor and oxygen helmet; Goldschmidt Thermit Company, pipe-welding equipment; Harrison Safety Boiler Works, feed-water heaters; H. W. Johns-Manville Company, insulators and supplies; Otto Gas Engine Works, gas engine; Ozone Pure Airifier Company, ozone machines.

Improved Electric Range

An electric range, which stands 65 in. from the floor to the top of the oven and occupies a floor space of 30 in. by 28 in., has been brought out by the Hughes Electric Heating Company, Chicago, Ill. The increase in height, it is expected, will save much of the labor of stooping to inspect the oven's contents. The body is built of steel with nickel trimmings and the oven is constructed on the fireless-cooker principle. The net weight of the stove is 165 lb.

With all burners turned on to give the highest temperature the stove will take 40 amp at 110 volts. Both top units

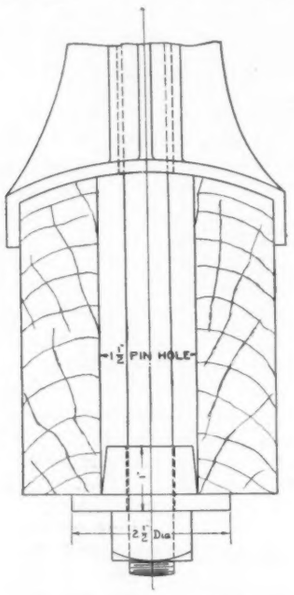
ELECTRIC RANGE

and burners are provided with so-called "three-heat" switches, giving low, medium and high temperatures, the resistance units consuming respectively 220, 440 and 880 watts at the various switch positions. The switches are located where they may be seen so that the cook may know from the switch dials at what temperature the plates or ovens are being operated.

Cross-Arm Washer

A washer or bushing of special design has been placed on the market by the Electric Service Supplies Company, of Philadelphia, Pa., for use in connection with truss pins on cross-arms.

The function which this washer performs is illustrated in the accompanying drawing. When used in conjunction

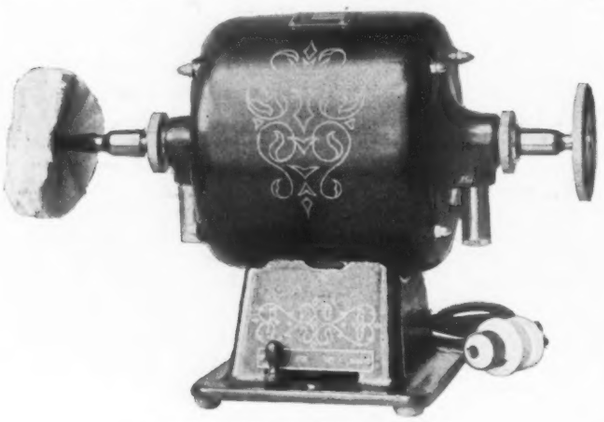


CROSS-ARM WASHER

with these pins the washers reduce the 1.5-in. cross-arm hole so that an iron truss pin having a curved base may be used. This adapter makes possible replacing wooden truss pins with iron pins without renewing cross-arms.

Motor-Driven Dental Lathe

The Westinghouse Electric & Manufacturing Company has placed on the market a motor-driven lathe designed especially for the use of dentists. The motor is made for operation on either direct-current or alternating-current lighting circuits and is rated at ⅙ hp. The lathes driven by alternating current have two speeds, and those driven by



MOTOR-DRIVEN DENTAL LATHE

direct current have three speeds. The sped changes are effected by a switch lever at the base, which also has an "off" position, so that the lathe can be stopped and started at the work.

The shaft is extended at both ends for mounting chucks which carry buffing and grinding wheels of various sizes, drills, burrs, etc.

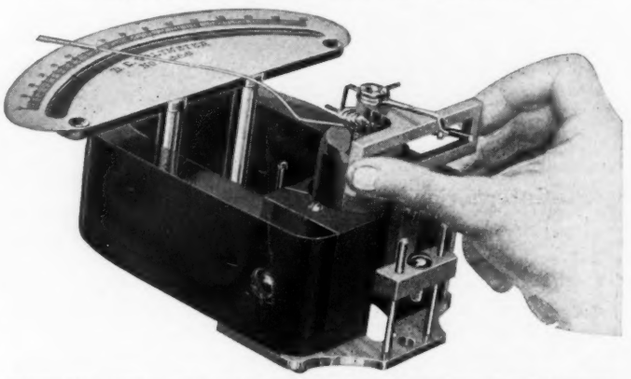
Glassware with Low Absorption Factor

A white glassware of exceptional reflecting and diffusing qualities is now being manufactured by the General Electric Company, Ltd., London, England. The claim is made for the new product that it has an absorption factor of about 5 per cent over the effective angle of illumination. The inner or reflecting surfaces of the units of this type are of a dull unpolished nature which is not affected by cleaning or rubbing. The outer surfaces are said to possess a subdued polish which combined with their whiteness and texture produces a pleasing effect. This "superflux" glassware, as it is called, is being manufactured in a variety of forms and sizes for use with lamps of all ratings.

High-Resistance Electric Pyrometer

Electric pyrometers in the past have been instruments of low resistance which when used with leads or thermocouples other than those supplied with the device or their exact duplicates were inaccurate to a considerable degree. With the high-resistance pyrometer just put on the market by the Brown Instrument Company, Philadelphia, Pa., it is claimed that the length of the leads may be varied from 1 ft. to 1000 ft. and the length of the thermocouple may be changed without causing more than a 5 per cent deviation from the correct readings. It is also claimed that the temperature of the leads does not affect the instrument readings.

An accompanying illustration shows the interior construc-



INTERIOR VIEW OF HIGH-RESISTANCE ELECTRIC PYROMETER

tion of the high-resistance system, the redesigned pole pieces and the small moving element. The internal resistance of both the indicating and recording type of instruments is 100 ohms. The moving element, which has been made as light as possible, is of the pivoted type and is supported in sapphire bearings. For the thermocouples either the metal base or the platinum is recommended by the manufacturers for use with the instrument.

Introducing Electric Washers to Housewives

One of the live agents for the Hurley Machine Company, Chicago, in a college town is using a novel method of acquainting housewives with the merits of the Thor electric home laundry machine. He first advertises that he will do any housewife's washing in her own home at so much per hour. Meanwhile he keeps in touch with a number of students working their way through college who are glad to earn a little extra money. When he gets a call he sends to the house a student with one of the washing machines. The student runs the washer and wringer, finishing in one-third the time it takes by hand, and takes the machine away. This novel advertising stunt effects several good results—the student makes some extra money, the housewife sees the advantages of the washer and usually orders one, and dealer and central station both profit.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Safety Lamp Finds Application.—The Mannesman Light Company of America, maker of the Ceag portable electric mine lamp, states that the device is finding a good sale in the Pennsylvania coal district. Among the recent buyers of this lamp are the Naomi Coal Company and the H. C. Frick Coal Company, the latter having purchased 300 for use in its various properties.

Appliance Manufacturer Specializing.—While about 60 per cent of its business is done in the standard lines of small heating and cooking appliances, the Simplex Electric Heating Company is giving an increased amount of attention to the pushing of its sales in larger and more specialized installations of similar apparatus. The entire equipment of factories, laundries, hotels and large private residences is proving a profitable end of the business which is capable of further development.

Missouri Manufacturer Moves Offices.—Because of a large increase in business, which made the carrying on of the same under the old arrangements inefficient, the American Carbon & Battery Company has decided to move its main offices from St. Louis to East St. Louis, where its factory is located, and this change will be effective on and after Oct. 1. Accompanying this change, the company announces that on the same date D. E. Ford, formerly with the Wesco Supply Company, of St. Louis, will join its staff as sales manager.

Chicago Office Opened.—The Detroit Fuse & Manufacturing Company has recently opened an office and established a warehouse in the Electric Building at 629 West Jackson Boulevard, Chicago. A full line of its products has been placed in stock, including "Arkless" fuses and iron-clad switches. The office is in charge of Morgan P. Ellis, who will take care of the Middle West business. This is the first time that the company has had its own office and warehouse in Chicago, having been represented by S. M. Farris before the recent change.

Big Turbine-Driven Blowers Installed.—At the power plant of the Rhode Island Company, Providence, R. I., there are to be installed shortly two of the largest turbine-driven forced-draft blower sets in the world. Each unit consists of a 600-hp Terry type C high-speed turbine driving, through a set of Falk reduction gears, one of the American Blower Company's No. 11 double-inlet Sirocco blowers. The capacity of each unit will be 250,000 cu. ft. of air per minute. The speed of the turbines will be 3370 r.p.m., while the blowers will run at 460 r.p.m.

Fer-Lux Lighting Glassware Shown.—The Max Schaffer Company, of New York, on the occasion of its removal from its old quarters at 258-260 Grand Street to its new and larger ones at 26 Warren Street, held a special fortnight exhibition of domestic and imported electric lighting glassware for indirect and semi-indirect systems. The showroom opening began on Sept. 15 and special attention was drawn to the line of Fer-Lux reflectors, shades and dishes. The company plans to carry a large stock so as to be ready to make prompt shipments on rush orders.

The Motograph Company of America, of Detroit, Mich., has closed a contract with the Federal Sign System (Electric) licensing the latter company to construct, operate and lease electrical display signs under the Motograph patents for the United States. At the last meeting of the board of directors F. C. Reilly, who has been prominent in the organization of the concern, was elected its president and general manager. Much comment was aroused by this company's sign at the recent convention of the National Electric Light Association in Chicago, a description of which appeared in the June 7 issue of the *Electrical World*.

Exhibits Allowed to Accompany Bids on Panama Canal Equipment.—In connection with the purchase of machinery and equipment for the Panama Canal an order was issued from the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., on Sept. 18, stating that, contrary to usual custom, manufacturers of such equipment would be allowed to file in that office at any time prior to the opening of the bids an exhibit consisting of triplicate copies of detailed specifications, descriptions or drawings covering any of the equipment (particularly the electrical equipment) to be furnished. These exhibits are to serve as an aid in describing the apparatus, and the points to be observed by bidders in order to have them perform this function in a clear, thorough and uniform manner are mentioned in the notice.

Business Conditions in Europe Said to Be Good.—The gist of an interview given by Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, on his return Sept. 19 from a five weeks' business visit abroad, was very optimistic. He claimed that business conditions in Europe are good, especially in Engand and France, and that a feeling of confidence has appeared. This gain, he said, has been rather along industrial than financial lines, but money conditions are improving. Regarding the operations and earnings of the European subsidiaries of the Westinghouse company, he said: "The English company is doing excellent business and earnings are better than ever. The French company is also doing good business. The Italian company has done all of the work in the electrification of the government railway and is now engaged in the manufacture of fifty locomotives for the Italian government."

Booming Detroit Electrically.—In connection with "Home-Made Week" in Detroit, Mich., an event which took place from Sept. 8 to 13 inclusive, the following electrical manufacturing concerns made exhibits of their products: American Electric Heater Company, Process Manufacturing Company, Smith Chandelier Company, John D. Templeton Company, Hoskins Manufacturing Company, Detroit Fuse & Manufacturing Company, American Electrical Heater Company, Thomas E. Clark Electric Laboratory, George H. Barnes Company, General Service Engineer, Electro Lamp Company, Raymond Electric & Manufacturing Company, Eureka Vacuum Cleaner Company, Dorigan Electrical Company, Dongon Electrical Manufacturing Company and Detroit Insulated Wire Company. So successful was this event, the first of its kind ever held in Detroit, that plans are already under way for a similar affair next year, although on a much larger scale.

Indiana Company to Build Large Transformer-Oil Plant.—It is understood that the Standard Oil Company of Indiana proposes to spend over $1,000,000 in the building of a plant addition at Whiting, Ind., for the manufacture of transformer oil, for which there is a large demand in the electrical industry. The Vacuum Oil Company, of Rochester, N. Y., which has hitherto been the largest producer in this field, has been handling its product through the larger electrical manufacturers, but the Indiana concern plans to handle it in a different way, selling direct to the consumer. It is claimed that this arrangement will be to the benefit of all concerned in the long run, since some advantage in freight rates is possible in all but a small territory, and there is less expense involved in the direct shipment to the consumer than in the shipping of large quantities to the big manufacturers, from whom second shipments have usually been made. The changed method of distribution will also remove from these manufacturers a burden in the shape of a special department foreign to the general character of their business.

New Type of Tungsten Lamp.—The Straight Filament Lamp Company, of 42 East Twenty-third Street, New York, has brought out a straight-filament incandescent lamp of the same type as its "Rayline" lamp, but with a tungsten filament instead of the carbon previously used. In order to obtain the required resistance it has been found necessary to make up the unit lamp with two bulbs, each the size of the regular single carbon lamp of that type, the two being connected in series. About 48 cp is obtained on a power consumption of 60 watts. One of the design features is the provision of three anchor wires to take part of the strain from the filament. While this lamp has been on the market for only about three weeks, it has met with success in two fair-sized installations, one at the new Manufacturers' Club, in Philadelphia, Pa., and the other on the pier at Atlantic City, N. J. This company is finding sales brisk and expects an exceptionally busy season in all of its lines.

Copper Prices and the Copper Wire Situation.—One of the large copper wire manufacturers, interviewed this week on conditions in that line and on the copper situation in general, stated that there is being experienced a large and steady demand for wire in various sizes and that if there is any point upon which any dissatisfaction can exist it is rather with respect to prices than to the volume of business. Conditions have reached such a basis in this branch of the electrical industry that further large improvements are not looked for either in design or material and there is pretty severe competition between the several large manufacturers for the larger orders. This results in fluctuating prices so that the volume of sales is not an absolute index of the financial status of the industry. This manufacturer, when questioned as to the outlook for higher copper prices, inclined to the opinion that these would come, but not with any suddenness such as has been predicted in some quarters lately.

New Regulator of the Automatic Rheostat Type to Be Made.—The Merrill Electric Manufacturing Company, with offices at 313 South Clinton Street, Chicago, has been organized for the purpose of manufacturing and marketing a new device called the Merrill electric regulator. This is described by the manufacturers as being a regulator of the automatic rheostat type but operating more rapidly than anything of this kind yet produced, and in fact comparing favorably in speed with vibrating-type regulators. Its resistance element is continuous and no friction is involved in its operation. According to the manufacturers, the device may be connected in the field circuit of a generator and wound to regulate either voltage or current and is also available for use in connection with storage batteries. F. W. Merrill, president, and J. L. Arthur, vice-president of the company, are chief engineer and assistant engineer, respectively, of Roth Brothers & Company, of Chicago, large motor manufacturers.

Lamp Factory Building in Minneapolis.—In the Aug. 26 issue of the *Electrical World* appeared a short description of the new lamp factory in course of construction at Minneapolis, Minn., for the Minnesota Lamp Works of the National Quality Lamp Division of the General Electric Company. Advices since received indicate that some of the figures then given were not accurate. The capacity of the plant at present under construction will be about 22,000 lamps per day and about 600 employees will be engaged. A ground area of 4½ acres will be covered by the structure and 150,000 sq. ft. of floor space will be available for manufacturing, testing and commercial departments. Semi-mill type construction will be used and a sprinkler fire protection equipment installed, together with the latest factory-lighting system. The operating equipment will consist of motor-generator sets and transformers receiving their energy from the local power company at 2300 volts. These lines will enter the building underground, and energy will be delivered through proper transformers to the distributing board, which is subdivided into circuits for each department of the plant. Each individual circuit will be metered so as accurately to determine the consumption of energy in the corresponding department. The apparatus is to be driven by individual motors or by motors from reduction transmission outfits to groups of apparatus, thus reducing to a minimum the use of belts. The testing will be handled through specially designed transformers with appropriate steps so as to give any voltage desired at the delivery point.

Riley Underfeed Stokers Sold.—The Toronto (Ont.) Electric Light Company, Ltd., has recently purchased 2200 hp of Riley self-dumping underfeed stokers, which are to be used in a stand-by steam station as a reliability reserve for the power from Niagara Falls. These boilers will carry banked fires continuously and must always be ready to pick up the load instantly in case of any transmission-line trouble. In this type of stoker the reciprocating movement of the grates, which slice the fire, is so well adapted to quick steaming that a boiler at the plant of the Narragansett Electric Lighting Company recently showed 300 per cent of rating in six minutes from a fire that was banked for twenty-four hours. Among the other companies to which the Sanford Riley Stoker Company, Ltd., of Worcester, Mass., has recently sold stokers of the above type are the following: New York Central Railroad, Weehawken, N. J., 2000 hp; Interborough Rapid Transit Company, Seventy-fourth Street station, New York, 500 hp; B. F. Sturtevant Company, Hyde Park, Mass., 400 hp; New York Central Railroad, Yonkers, N. Y., 500 hp; Worcester (Mass.) Electric Light Company, 1500 hp; Municipal Power Plant, Regina, Sask., 3000 hp; Glenlyon Dye Works, Phillipsdale, R. I., 500 hp; International Railway Company, Buffalo, N. Y., 800 hp, and the Youngstown Sheet & Tube Company, Youngstown, Ohio, 2500 hp.

Legislation for Protecting Foreign Exhibitors at the San Francisco Exposition.—In order to secure the exhibits of England, Germany and some other foreign countries at the Panama Pacific Exposition in 1915 it was necessary for Congress to pass some measure for the protection of the exhibitors from those countries against piracy of their designs and ideas by American manufacturers, or, more properly speaking, by a certain class of American manufacturers who are content to do business on this plane, since the present patent laws in this country are not of broad enough scope to give any protection in matters of this kind. A bill introduced by Representative Kahn, of California, and passed by both houses of Congress, provides for the granting of an American certificate of registration on all designs exhibited by foreign manufacturers where they have a certificate of registration, trade-mark, patent or copyright issued by any foreign country. This American certificate is to protect the design from unauthorized use by American manufacturers for a period of three years after the close of the Exposition. There has developed a strong opposition to this measure on several important grounds. In the first place it proposes to give a form of protection to foreign exhibitors that is not afforded to American manufacturers. It is also open to the objection that the certificates issued by foreign countries are of small value comparatively, since they are in many cases obtained without the formality of an investigation of the design, that step being put off until such time as litigation for alleged infringement arises. Besides this, the Kahn measure does not provide that the designs registered abroad shall be original, but plans to give protection to any design with a foreign certificate. If it is finally passed and signed, the bill will enable foreign manufacturers to bring over old designs or ones which they have borrowed from American manufacturers—in either case designs which are now in use in this country and at present legally protected—and, by virtue of consenting to their exhibition, obtain the right to control their manufacture and sale in this country for a period of from three to four years, irrespective of the present rights of the American manufacturer. The Kahn measure was regarded as so imperfect in the above-mentioned points and so fraught with danger to legitimate American interests that the Federation of Trade Press Associations of the United States at its annual convention in New York on Sept. 18-20 appointed a committee to draw up and file a protest against the signing of that bill. However, this association advocates strongly the passing of proper laws for the protection of foreigners as well as of American manufacturers against design piracy, and at its convention steps were also taken preliminary to the calling of a convention at which might be discussed by representatives of all of the interested parties measures for getting efficient laws for this purpose passed.

Corporate and Financial

American Public Utilities Company Subsidiaries.—A bulletin issued by the American Public Utilities Company contains a map showing the location of its various operating plants. The United States Census for 1910 showed a total population in the cities served by the operating subsidiary plants of 471,451, against 332,929 for the year 1910, or an increase of 41 per cent.

Appalachian Power Company Changes.—A number of changes have been made in the officers and directors of the Appalachian Power Company. Mr. Frank L. Dame, Mr. Robert C. Morse, Mr. Ernest L. Carr and Mr. F. C. Walcott have been made directors. Mr. Morse succeeds Mr. H. M. Byllesby as president, and Mr. Walcott has been made a vice-president. Mr. Byllesby is a vice-president and a member of the board. Mr. A. P. Taliaferro has been made secretary-treasurer to succeed Mr. R. J. Graf.

Columbus Reorganization.—A decision has been rendered by the Court of Common Pleas, Columbus, Ohio, denying the contention of the stockholders of the Columbus Light, Heat & Power Company that the proposed plan of reorganization of the Columbus Railway & Light Company should have been approved by shareholders of the various subsidiary companies before its submission to the Public Service Commission of Ohio. The court held that the plan could be submitted to either the commission or the stockholders first.

San Joaquin Light & Power Corporation Results.—The San Joaquin Light & Power Corporation reports gross earnings for the year ended June 30, 1913, of $1,608,960, as compared with $1,379,912 for the preceding year. Operating expenses, maintenance and taxes amounted to $624,179, as compared with $537,701. The net income was $984,781, as compared with $842,211. Interest charges amounted to $359,734, as compared with $339,852. The surplus was $625,047, as compared with $502,357. Preferred dividends amounted to $390,000.

Alabama Power Consolidation.—The Alabama Power Company has been formed as a consolidation of the Alabama Power Company, the Alabama Electric Company, the Wetumpeka Power Company, the Alabama Power & Electric Company and the Alabama Power Development Company. The companies which have been merged are subsidiaries of the Alabama Traction, Light & Power Company. The Alabama Power Company will have an authorized issue of $20,000,000 bonds, all of which will be deposited as security under the $10,000,000 first mortgage bond issue of the Alabama Traction, Light & Power Company.

Northern Ohio Traction & Light Company Bonds.—An issue of $1,500,000 new collateral trust 6 per cent bonds has been made by the Northern Ohio Traction & Light Company. The bonds are dated Aug. 1, 1913, and are due $100,000 annually on Nov. 1 of 1914, 1915 and 1916, and thereafter at the rate of $100,000 semi-annually until Nov. 1, 1922. They are redeemable, however, in whole or in part at 101 and interest. The bonds are offered by Hayden, Miller & Company, of Cleveland, at par and interest. They are secured by a deposit of $2,300,000 of various mortgage bonds issued by the company or its subsidiaries.

United Gas & Electric Corporation Report.—The United Gas & Electric Corporation has issued a report for the twelve months ended June 30, 1913. The statement of earnings, as compiled, includes the equity in the net earnings of subsidiary companies whether or not received as dividends. The total stated as direct earnings, less expense, is $1,214,824. This amount is made up of the direct earnings, less expenses, of the corporation, and the net earnings of its subsidiary companies, after the deduction of dividends on the preferred stock of the subsidiary companies, including the equity of direct subsidiary companies in the operations of their respective subsidiary companies, calculated on the basis of their holdings at the end of the year. From the amount stated there were deducted as interest on notes $283,125, and for preferred dividends $555,738, a total of $838,863. This leaves a surplus of $375,981. Of the surplus earnings determined in this way the proportion added to the surplus account of subsidiary companies and not declared as dividends was $369,969, leaving as the net addition to the surplus of the United Gas & Electric Corporation from operations $6,012. Of the sum of $369,969, added to the surplus of subsidiary companies and from the previous accumulations of surplus of such companies, various amounts were charged during the year on account of extraordinary expenditures which were not held to be applicable directly to the operations of the year. Of these amounts, the proportion corresponding to the holdings of the United Gas & Electric Corporation is $133,420. The balance sheet surplus as of June 30, 1913, was $116,508.

Electrical Receipts of American Railways Company Subsidiaries.—The fourteenth annual report of the American Railways Company, covering the fiscal year ended June 30, 1913, shows that the increase in receipts from lighting and power furnished by the subsidiary companies was 15.18 per cent. The gross receipts of the subsidiary companies from all sources, amounting to $5,164,007, gained only 5.55 per cent. The report refers to various improvements made in physical properties during the year. The Home Electric Light & Steam Heating Company, of Tyrone, Pa., obtained 213 new customers, an increase of almost 14 per cent. A contract was made for five years with the borough of Tyrone at a fair advance in the price of lighting. The business of the lighting department of the Roanoke Railway & Electric Company has been extended and shows an increase of about 16.5 per cent. The Scranton Railway Company has made a contract for power with the Scranton Electric Company. The loss in gross receipts of subsidiary companies during the March floods in Ohio was about $50,000.

Progress of the Consolidated Company of Baltimore.—A booklet has been issued to show the development of the Consolidated Gas, Electric Light & Power Company of Baltimore since the formation of the present company in 1906. The total gross income of the company in the fiscal year ended June 30, 1913, was $6,114,973, an increase of 70.07 per cent over the year ended June 30, 1906. The other items in the statement and the percentage of increase in 1913 as compared with 1906 were as follows: Operating expenses and taxes, $2,963,180, increase 52.62 per cent; net earnings, $3,151,793, increase 90.56 per cent; interest, $1,476,768, increase 25.49 per cent; surplus, $1,675,025, increase 250.99 per cent; dividends, $810,673, increase 77.27 per cent; balance, $864,352, increase 4,238.25 per cent; reserve for depreciation, amortization, etc., $460,000, no reservation made in 1906; surplus, $404,352, increase 1,929.48 per cent; special reserve, $300,000, no reservation made in 1906; net surplus, $104,352, increase 423.76 per cent. A table is published which shows various statistical results. The number of electrical customers in the 1913 fiscal year was 29,927, an increase of 16,272, or 119 per cent, over the fiscal year ended June 30, 1908. Sales were made last year of 94,876,887.7 kw-hr., an increase of 192 per cent over the 1908 year. The income from the sale of electric energy last year was $2,801,995, an increase of 92 per cent over 1908.

NEW YORK METAL MARKET PRICES

	Sept. 15 Bid.	Sept. 15 Asked.	Sept. 22 Bid.	Sept. 22 Asked.
Copper:				
Standard, spot*	.....	17.60	.....	.....
	Selling Prices £ s d		Selling Prices £ s d	
London, standard, spot*	74 15 0		72 15 0	
Prime Lake	16.75	to 16.87½	16.75	.....
Electrolytic	16.62½	to 16.75	16.50	to 16.62½
Casting	16.37½	to 16.62½	16.37½	to 16.50
Copper wire base	17.75	to 18.00	17.75	to 18.00
Lead		4.75		4.75
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		8.00		8.00
Spelter, spot	5.85	to 5.90	5.80	.....
Tin, spot*	42.75	to 43.00	41.50	to 41.87½
Aluminum:				
Prompt delivery	21.50	to 22.50	21.50	to 22.50
Future	20.00	to 21.00	.....	.....

*OLD METALS

Heavy copper and wire	14.75	15.00
Brass, heavy	9.25	9.75
Brass, light	8.25	8.50
Lead, heavy	4.65	4.65
Zinc, scrap	4.75	4.75

*COPPER EXPORTS

Total tons to Sept. 22 21,575

*From daily transactions on the New York Metal Exchange.

Business Notes

The American Insulating Machinery Company, of Philadelphia, Pa., announces the removal of its plant and office from the corner of Hancock and Oxford Streets to the northwest corner of Fairchild and Huntingdon Streets.

The Arthur Jones Electric Company, of 223 South Clinton Street, Chicago, has secured the services of A. W. Paine as assistant manager in charge of sales. Mr. Paine was formerly connected with the General Electric Company in its sales department.

The H. P. B. Electric Company, with main office at Rye, N. Y., has completed arrangements with the Chelten Electric Company, of Philadelphia, Pa., for the manufacture of its line of switches for use in connection with electric ignition, lighting, starting and horn equipments on automobiles.

The Esterline Company, Indianapolis, Ind., through its president, Mr. J. W. Esterline, announces the appointment of Mr. W. McK. White as sales manager. Mr. White will have charge of the company's products for automobile lighting, self-starting, etc., while the electrical-instrument department will continue to be directed by Mr. Hansell. In the future Mr. Esterline expects to devote the major part of his own time to technical study of the fields in which the company is engaged. The Esterline Company recently moved to Indianapolis from Lafayette in order to secure increased manufacturing facilities for producing its lighting system for automobiles, motor boats, locomotives, harbors, street railways, etc., and for its several other electrical appliances.

New Industrial Companies

The Broad Electric Company, of Wilmington, Del., has been chartered with a capital stock of $100,000 to manufacture and deal in removable and refillable batteries.

The Derby Electrical Engineering Company, of Derby, Conn., has filed a certificate of incorporation with the Secretary of State with a capital stock of $5,000. The incorporators are: Charles J. Dickgiesser, Clinton W. Gray and John T. Donnelly.

The Killman Hydraulic Power & Transmission Company, of Tullahoma, Tenn., has been incorporated with a capital stock of $100,000. The company proposes to use the Killman improvements for the transmission of power in the manufacture of automobiles.

The Holley Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical appliances, etc. The incorporators are: William V. Holley, Arthur E. Carpenter, 1476 Broadway, New York, N. Y., and Frank S. Barnett, 87 Burnett Street, East Orange, N. J.

Trade Publications

Second-Hand Machinery.—Archer & Baldwin have issued their August list of used electrical and steam machinery, power-house equipment, cars, etc.

Tools.—The Smith & Hemenway Company, 150 Chambers Street, New York, has recently issued a catalog listing the net price of 3000 "Red Devil" tools.

Second-Hand Machinery.—In a booklet of twenty-two pages the firm of George Sachsenmaier & Company, 142 North Third Street, Philadelphia, publishes its latest list of used electrical machinery on hand.

Insulators.—Folder 4187, issued by the Westinghouse Electric & Manufacturing Company, covers type KB section insulators. The iron parts of this device are sherardized, and wearing parts are renewable. It is said to be an unusually strong and light-weight insulator.

Table Clamp.—Edwards & Company, 140th and Exterior Streets, New York, have issued a small folder telling briefly about their new table clamp, a detachable signal for dining-room tables and other similar purposes. The device can be easily and securely attached to the table.

Turbines.—Victor-Francis turbines are fully described in Bulletin 708 issued by the Platt Iron Works Company, Dayton, Ohio. Pictures of a number of installations of this apparatus in various power plants are shown.

Motors.—Descriptive Leaflet No. 3698 issued by the Westinghouse Electric & Manufacturing Company covers motors for driving intertype and linotype machines. The characteristics necessary for this service are explained, and application views are shown of motors driving these machines.

Single-Phase Motors.—Single-phase motors are the subject of Bulletin No. 101 issued by the Wagner Electric Manufacturing Company, St. Louis, Mo. A general description of the apparatus is given, accompanied by many illustrations in some of which are shown their application in various industries.

Reflectors.—In an attractive booklet issued by the Gleason-Tiebout Company, 71 West Twenty-third Street, New York, two designs of reflector bowls in special shapes are shown. An invitation is extended to the reader to visit the company's new showrooms and to inspect its full line of artistic semi-indirect glassware.

Measuring Instruments.—In Bulletin G, 1913, the Thompson-Levering Company, Philadelphia, Pa., gives descriptions and illustrations of its line of measuring instruments. The Peerless switch-dial testing set, the portable testing set, plug set, improved fault-finder, portable cable-testing outfits and other instruments are referred to.

Transformer Shipments.—Leaflet No. 3569, issued by the Westinghouse Electric & Manufacturing Company, describes and illustrates the shipment of transformers in tanks with oil. This method has been adopted in the shipment of large transformers, as it enables them to be installed immediately upon arrival at destination.

Ball Bearings.—The Hess-Bright Manufacturing Company, Philadelphia, has recently published some additions to its loose-leaf series 336. Sheet 95, Class IX, refers to ball bearings on vertical spindle of matching machine, and Sheet 96, Class IV, describes and illustrates adjustable mountings for automobile bevel driving pinions and gears.

Small Turbines.—The De Laval Steam Turbine Company, Trenton, N. J., has published in booklet form a paper by Mr. George H. Gibson, entitled "Improved Methods of Connecting Small Turbines in Steam Power Plants and Exhaust Steam Heating and Drying Systems," reprinted from the *Journal* of the Engineers' Society of Pennsylvania. It refers to the De Laval apparatus.

Transformers.—Catalog 130 of the Adams-Bagnall Electric Company, Cleveland, Ohio, devoted to transformers for lighting and power, is divided into two sections. Section 1 refers to A-B constant potential transformers and Section 2 to balancers. Some general information on balanced design in potential transformers, illustrations and diagrams of special transformer connections make up the contents.

Household Appliances.—In connection with its line of nickel and silver plate, solid copper and aluminum ware, Manning, Bowman & Company, Meriden, Conn., manufacture various electrical appliances. These are fully illustrated in the company's mammoth catalog, No. 63, recently issued. In it electric coffee percolators, tureens, toasters, chafing dishes and numerous other devices are excellently illustrated. Dimensions and prices are given.

Conduit.—A pamphlet of sixteen pages has been issued by the American Conduit Manufacturing Company, Pittsburgh, Pa., devoted to "galvanite," a conduit treated by an electrolytic process which is said to produce an article that is non-corrosive and capable of resisting mechanical injury. Comprehensive information regarding the manufacture of the product is given, and also a partial list of installations, in which are included the names of many prominent buildings in the country.

Lighting Plants.—Bulletin No. 110 issued by the United States Light & Heating Company, Niagara Falls, N. Y., refers to electric-light low-voltage isolated plants for country homes, small hotels and clubs. A plant for this purpose usually consists of an internal-combustion engine, a direct-current generator, a storage battery and a switchboard and is said to be easy to install and operate. The bulletin describes in detail many types of plant and the method of figuring on a plant to meet any requirement.

Personal Mention

Mr. R. C. Morse, of Boston, Mass., has been elected president of the Appalachian Power Company, of Bluefield, W. Va.

Mr. D. W. McGee has been appointed local manager of the Fort Lupton (Col.) Light & Power Company as successor to Mr. O. F. Nats.

Mr. R. S. Smyth, formerly with the Hornell (N. Y.) Electric Company, has been appointed manager of the Dansville (N. Y.) Gas & Electric Company.

Mr. H. C. F. Poste, formerly superintendent of the Canadian Light & Power Company at St. Timothée, Quebec, has been appointed superintendent of the entire system.

Mr. O. F. Nats, formerly manager of the Fort Lupton (Col.) Light & Power Company, has been transferred to the Arapahoe Electric Light & Power Company of Littleton, Col., as superintendent.

Mr. Thomas Shipley, of York, Pa., was elected vice-president of the American Association of Refrigeration at the annual meeting in Chicago on Sept. 22. He is vice-president of the York Manufacturing Company.

Mr. W. T. Edmondson, Jr., new-business manager of the Alliance (Ohio) Gas Power Company, has severed his connection with that company to become sales manager in the South for the Premier Vacuum Cleaner Company. Mr. Edmondson will make his headquarters at Montgomery, Ala., after Oct. 1.

Mr. J. S. Alexander, superintendent of the Houghton County Electric Light Company, of Houghton, Mich., has been transferred to the Savannah (Ga.) Electric Company, which is also managed by the Stone & Webster Management Association. Mr. C. Curtis is the present superintendent of the company at Houghton.

Mr. Edwin W. Allen, recently promoted to be assistant district manager of the Chicago office of the General Electric Company, will continue to act as district engineer in the Chicago office. Mr. Allen is a native of Buchanan, Va., and was born in 1879. He was graduated from the Virginia Polytechnic Institute, class of 1900, taking the course of electrical engineering. A year later he entered the testing department of the General Electric Company at the Schenectady works. After two years' training in this department he was transferred to the engineering department under Mr. W. L. Emmet. Here he remained until Oct. 1, 1911, when he was sent to the Chicago office as district engineer, succeeding Mr. James Lyman, resigned. Mr. Allen is an associate of the American Institute of Electrical Engineers and secretary of the Chicago Section of that society. He is also a member of the Engineers' Club of Chicago and has read several papers before technical societies.

EDWIN W. ALLEN

Mr. Frank L. Dame has joined the staff of Mr. Harrison Williams, New York. He has just been elected a director of the Central States Electric Corporation and the Appalachian Power Company. Mr. Dame was vice-president of the Electric Bond & Share Company, in charge of the operating department, from 1909 until Jan. 1, 1913. Since his resignation from that position he has been taking a long vacation. Mr. Dame is a graduate of the Massachusetts Institute of Technology. For some years he was connected with the General Electric Company interests on the Pacific Coast and afterward was general manager of the Union Electric Company, Dubuque, Ia. He resigned from that position to become engineer for the Electrical Securities Corporation shortly after the organization of that company in 1904. He held that position until his resignation in 1909 to become vice-president of the Electric Bond & Share Company.

Mr. Edward W. Lloyd, of Chicago, general contract agent of the Commonwealth Edison Company and third vice-president of the National Electric Light Association, is one of the real workers in the electric-service industry. Born on Feb. 3, 1872, in Belleville, Ont., Mr. Lloyd spent his boyhood in Erie, Pa. He attended school in that city, but shortly before graduating from high school he began work in a machine shop and partially learned the machinist's trade—a training that was valuable to him in after life. While thus at work he attended night school and studied drawing, and afterward he became a draftsman in local manufacturing concerns in Erie. In 1890 he sought a larger field in Pittsburgh, and in that city he worked as a draftsman for engineering firms engaged in the design and construction of steel plants. Two years later the young man came to Chicago and secured employment with the Crane Elevator Company as a draftsman. In 1893 he formed a connection with the Chicago Edison Company, predecessor of the Commonwealth Edison Company, which has lasted until the present time. Mr. Lloyd's first experience in central-station work was as a draftsman in the electrical department of the company, working on the plans for the Harrison Street station. Gradually he worked into steam testing and general work in the engineering division under the construction engineer. He calibrated instruments and gained a general and diversified experience in the practical features of electrical engineering and construction. In 1898 Mr. Lloyd was transferred to the construction department as a foreman. He developed an aptitude in selling second-hand machinery acquired in shutting down isolated plants and gradually grew familiar with the selling end of the business by estimating on wiring jobs as he had opportunity. In 1902 Mr. Lloyd was made assistant superintendent of construction under Mr. J. H. Goehst. His practical experience and mental alertness proved valuable in getting customers for the company in industrial work. In 1906 he was promoted to be general contract agent of the company. Mr. Lloyd's department has charge of selling the output of the Commonwealth Edison Company and he has about 200 men under him. For a number of years Mr. Lloyd has been prominent in association work. He has written a large number of papers and reports relating to the commercial side of the business for the National Electric Light Association and the Association of Edison Illuminating Companies. His first paper, on "Purchased Electric Power in Factories," was read before the Edison convention ten years ago, and he presented a report on the same subject at the Denver convention of the N. E. L. A. in 1905. He has contributed to the proceedings of these associations nearly every year since then. He is chairman of the heating committee and the electric-vehicle committee of the Edison association and has been chairman of the rate research committee of the N. E. L. A. since 1911. This committee maintains permanent quarters and has done excellent work, for which Chairman Lloyd and the company backing him are to a considerable degree responsible. Mr. Lloyd has served as a member of the executive committee of the Commercial Section of the N. E. L. A. since its organization in 1910. For the year 1912-13 he served as chairman of the Commercial Section. At the Chicago convention of the N. E. L. A. in 1913, to the success of which he contributed not a little, Mr. Lloyd was made third vice-president and a member of the executive committee of the whole association. He is a man of keen discernment, an enthusiast regarding the usefulness of electricity, yet practical withal and with an apparently unlimited capacity for work. Mr. Lloyd is an associate of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society, the Society for Electrical Development and the Electric Club of Chicago, as well as the Chicago Athletic, Union League and Midday clubs and a number of Masonic organizations.

EDWARD W. LLOYD

Construction

New England

BIDDEFORD, MAINE.—The Pepperell Mfg. Co., of Biddeford, is planning to build a concrete dam (70 ft. high) at Union Falls. It is proposed to locate the dam just below the present dam at Union. It is estimated that 10,000 hp can be developed at a cost of $1,000,000. The Pepperell company has purchased the electric plant of the Clark Pwr. Co. at Union, which furnishes electricity in the towns of Hollis, Bar Mills, Salmon Falls and Clark Mills.

ATHOL, MASS.—The Athol Gas & El. Co. expects to purchase within the next six months 1000-hp waterwheels and 680-kw generator for its plant at Wendall Depot. Paul B. Webber, 35 Congress Street, Boston, Mass., is treasurer.

BEVERLY, MASS.—The Beverly Gas & El. Co. is building about 12 miles of underground conduits, using Orangeburg fiber conduits, material for which has already been purchased. It is expected to have the conduits finished and the cables nearly pulled through by Jan. 1, 1914. A. W. Rogers is treasurer and general manager.

BOSTON, MASS.—Plans are being prepared, it is reported, by the Commonwealth Ice & Storage Co. for the construction of a cold-storage and power plant on Pier 6, Northern Avenue, to cost about $300,000. The building will be eight stories high, 220 ft. by 250 ft., built of concrete and steel.

BROCKTON, MASS.—The Edison El. Ltg. Co. of Brockton is erecting a 13,000-volt transmission line from East Bridgewater via Whitman to the plant of El. Lt. & Pwr. Co. of Abington and Rockland in North Abington. The line will form a complete triangle so that Brockton, Abington and Whitman can be supplied with energy either way in case of trouble with the lines.

GREENFIELD, MASS.—During the past summer the Amherst Pwr. Co. has erected a two-circuit steel-tower line from Turner's Falls to Springfield, which will operate at 66,000 volts, three-phase, 60 cycles. The spacing of the towers is arranged so that the line can eventually be operated at 110,000 volts. A substation has been built at Amherst containing a bank of transformers which step down to 2300 volts to supply the local requirements of Amherst. This substation also includes a ring bus and complete sectionalizing switches for the transmission line. The company has built and now has in operation at Chicopee Falls a substation equipped with one 4500-kw bank of outdoor oil-cooled transformers and complete outdoor switching station for 66,000 volts; inside the station a 13,200-volt concrete bus structure and distributing switchboard has been placed. Current is transmitted from this station at 13,200 volts. This station is also equipped with motor-generator set to supply energy to the Springfield St. Ry. Co. at Chicopee Falls. A duplicate of this station has been built in Agawam and will be in operation within another month. In addition to the equipment at Chicopee, this station contains a 2300-volt switchboard for local distribution in Agawam, energy to be sold to the Agawam El. Co. F. L. Hunt is chief engineer. The office of general manager and engineering department is at Greenfield.

GREENFIELD, MASS.—Contracts were awarded early in the summer by the Greenfield El. Lt. & Pwr. Co. for extensive additions and remodeling of its Gardner Falls water-power plant near Shelburne Falls. An extension has been erected to the power house (about 68 ft., with the side walls raised). New equipment will be added to the plant, consisting of two 1170-kva, 2300-volt vertical generators with two 1400-hp single-runner waterwheels, one 60-kw vertical waterwheel-driven exciter set, one 60-kw motor-driven exciter set, and complete new switchboard with switches in concrete cell structure. The old generators will be changed to 2300 volts and three 1200-kva, three-phase, water-cooled transformers, 2300 volts to 13,200 volts, will be installed. The waterwheel equipment has been purchased from the S. Morgan Smith Co., of York, Pa.; electrical equipment from the General Electric Co., and the governors from the Woodward Governor Co. The plant originally contained two 400-kw horizontal wheels and generators, generating current at 11,000 volts. A small amount of current was stepped down to 2300 volts for local distribution. It is expected to have the new equipment in operation by Jan. 1, 1914. The company has also recently awarded contracts for rebuilding an old dam on the Green River, opposite its steam plant in Greenfield. The dam will be of concrete and is built primarily to supply a condenser pond for the steam plant. The company is installing a small horizontal wheel and induction generator which will have an output of 75 kva and will generate energy and feed into its system when no water is available. Bids are now being received on transformers to replace those now in the present Greenfield station in order to increase the output so that the transformer voltage between Gardner Falls and Greenfield, between Turner's Falls and Greenfield and between Northfield and Greenfield will be changed from 11,000 volts to 13,000 volts; the output in Greenfield will be approximately doubled. F. L. Hunt is chief engineer.

HUDSON, MASS.—Right-of-way, it is reported, is being secured by the Connecticut River Pwr. Co., of Brattleboro, Vt., for the erection of a transmission line into Hudson. The company is said to be negotiating with the Apsley Rubber Co., Hudson, to furnish energy to operate the plant of the latter.

SPRINGFIELD, MASS.—Arrangements, it is said, are being made to equip the Tariffsville branch of the Hartford & Connecticut Western Railroad for electrical operation. Overhead wires will be erected between Tariffsville and Springfield.

WAKEFIELD, MASS.—The town of Wakefield expects to build an underground conduit system through the center of the town in connection with the municipal electric-lighting system. S. L. Cole is manager.

Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the Board of Contract and Supply of the city of Binghamton until Oct. 15 for the construction of a high school building and a heating and power plant, building to be erected on the site of the present high school. Plans and specifications may be seen at the office of the city clerk, Municipal Building, Binghamton, and at the office of C. Edward Vosbury, architect, Binghamton Savings Bank Building, Binghamton. Copies of plans and specifications may be obtained upon application to the architect.

BROOKLYN, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 7 for the installation of a complete new electric elevator plant and a hydraulic pumping plant in the United States post office in Brooklyn, in accordance with drawings and specifications copies of which may be obtained at the above office or at the office of the supervising chief engineer. O. Wenderoth is supervising engineer.

CHITTENANGO, N. Y.—At a special election held Sept. 13 the proposition to light the streets of the village with electricity was carried.

GLENS FALLS, N. Y.—The State Conservation Commission has given its approval of the plans for the construction of a multiple-arch concrete dam in the Hudson River at Palmer Falls, to cost $250,000, and a concrete dam at Glen Street, Glens Falls, to cost $100,000, by the International Paper Co. These will replace wooden structures and the water will be used in operating pulp mills.

GOUVERNEUR, N. Y.—The Northern New York Marble Co., of Gouverneur, is erecting a new mill on the site of the old mill burned last winter. An electric generator will be installed to supply electricity to operate the machinery and for lighting the mill.

NEW BERLIN, N. Y.—The New Berlin Lt. & Pwr. Co. expects to purchase within the next two months a 100-hp boiler and 75-hp engine. G. H. Butterfield is treasurer.

PORT HENRY, N. Y.—The State Conservation Commission has approved plans and specifications of the Port Henry Lt., Ht. & Pwr. Co. to build a dam at North Bend, in the town of Moriah.

SCHENECTADY, N. Y.—The Schenectady Illg. Co. has recently signed a contract with the city of Schenectady to furnish an ornamental street-lighting system, beginning Oct. 24. The contract provides for 60 6-amp inverted magnetite-arc lamps on ornamental iron posts, placed approximately 100 ft. apart, with staggered arrangement through the business section of State Street. The lamps and station equipment are to be furnished by the General Electric Co. and the ornamental posts by the Ornamental Pole Ltg. Co. C. S. Van Dyke is superintendent of operating department.

WATERTOWN, N. Y.—The New York Utilities, Inc., of Watertown, has applied to the Public Service Commission for permission to construct a hydroelectric plant and to issue bonds and stock for the purpose of purchasing water rights and land located on the Beaver River near the hamlet of Belfort, Lewis County. The present plans provide for the construction of a dam at Violet Falls over 1000 ft. long, the water to pass through three waterwheel units of about 1800 hp each. About three-fourths of the work has been done and it is expected to complete the entire project by Jan. 1, 1914. C. C. Burns is president of the company, and J. B. Taylor is treasurer.

WAYLAND, N. Y.—The Wayland El. Lt. & Pwr. Co. expects to purchase within the next three months one 100-kw, three-phase, 2200-volt generator and within the next 10 days some transformers and No. 4 and 8 wire.

ALBURTIS, PA.—The Borough Council is reported to have accepted the proposition of the Allentown El. Lt. & Pwr. Co., of Allentown, to furnish electrical service here.

CHAMBERSBURG, PA.—Bids will be asked in the near future for the construction of a one-story brick addition to the municipal electric-light plant, to cost about $3,000.

CHAMBERSBURG, PA.—Plans are being prepared by W. R. Rhoads, 476 Broad Street, Chambersburg, for the construction of a one-story brick, concrete and steel power plant for Wilson College, Chambersburg. George Barlett, of Chambersburg, is director.

EAGLES MERE, PA.—The Eagles Mere Lt. Co. expects to purchase within the next three months two automatic feeder regulators, 5 kva each, 60 cycles, 2200 volts. R. D. Kehrer is general manager.

EVERETT, PA.—The property of the Everett Lt., Ht. & Pwr. Co. has been purchased by H. G. Frederick and F. S. Bradenbaugh, of Millersburg, who own and operate five other water plants in this State.

MEDIA, PA.—The municipal electric light committee will install an additional 100-kw alternating-current generator directly connected to an engine (either steam or internal combustion) and will also make extensions to transmission lines. Bids for the work will probably be received in January, 1914. P. E. Ahearn is superintendent.

PITTSBURGH, PA.—The Armstrong Cork Co., of Pittsburgh, does not contemplate making any extensions to the electrical equipment of its plant. The proposed improvement consists only of replacing two boilers.

STEELTON, PA.—The Borough Council has authorized the finance committee of the Council to secure estimates for the installation of a municipal electric-light plant, and also on the cost of securing energy from the York Haven plant.

WARREN, PA.—The contract for furnishing material and construction of power house at the Pennsylvania State Hospital at Warren has been awarded to the Henry Shenk Co., of Erie, Pa., for $36,946. The Alphons Custodis Chimney Const. Co., of New York, N. Y., was awarded a contract for brick chimney for this power house. L. E. Marks and J. E. Woodwell, 103 Park Avenue, New York, N. Y., are engineers.

CAMDEN, N. J.—The Public Service Corpn. has submitted a proposition to the street committee of the City Council to place its wires underground. The cost of the work is estimated at about $250,000.

SOUTH BOUND BROOK, N. J.—Bids will be received by the Mayor and the Borough Council until Oct. 1 for lighting the streets of the borough for a period of five years. Peter Merlett is borough clerk.

BLUEFIELD, W. VA.—The stockholders of the Appalachian Pwr. Co. have approved an issue of $3,000,000 in bonds, the proceeds to be used for taking up floating indebtedness and for improvements and extensions to its property. Robert C. Moore was elected president.

BLUEFIELD, W. VA.—The Appalachian Pwr. Co., of Bluefield, has awarded the contract for construction of a power house at Bluestone Junction to C. H. Hancock, of Lynchburg. The proposed power plant will furnish energy to operate the Norfolk & Western Railroad between this city and Vivian.

WHEELING, W. VA.—The West Virginia Trac. & El. Co. is reported to have placed orders for a 5000-hp engine for the Elm Grove plant, to replace the one which recently broke down.

CLINTWOOD, VA.—Arrangements are being made for the installation of an electric-light plant in Clintwood. Harman and John Mullins are reported to be interested in the project.

MILLBORO, VA.—The Millboro Lumber Co. is contemplating the installation of an electric-light plant and water system in connection with its proposed single-band mill. J. M. Murdock, of Johnstown, Pa., is president.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 7 for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 5867—repairing and converting batteries. Brooklyn, N. Y., Schedule 5853—140,000 ft. silicon bronze aerial wire, miscellaneous annealed brass wire and copper binding wire. Bids will also be received until Oct. 14 as follows: Eastern yards, Schedule 5863—10 sets turbine-driven, circulating pumps, complete with turbines; Boston, Mass., Schedule 5862—two electrically operated deck winches; Brooklyn, N. Y., Schedule 5878—two three-motor (electric) traveling wall cranes. Bids will also be received until Oct. 21 as follows: Puget Sound, Wash., Schedule 5864—one motor-driven grinding machine. Norfolk, Va., Schedule 5887—one motor-driven spiral disk grinder. Boston, Mass., Schedule 5888—one motor-generator set. Bids will also be received until Oct. 28 for the following supplies: Mare Island, Cal., Schedule 5879—one electrolytic, oxygen-hydrogen generating plant. Puget Sound, Wash., Schedule 5869—one three-drum sander, complete with motor, etc.; Schedule 5882—one 10-ft. power squaring shears; Schedule 5869—one 8-in. by 30-in. double surfacer, complete with motor, etc. Bids also will be received until Nov. 4 as follows: Pearl Harbor, Hawaii, Schedule 5871—12,000 ft. three-conductor, paper-insulated, lead-covered cable; miscellaneous fiber conduit; Schedule 5872—telephone switchboard, etc., and 50 common-battery telephones. T. J. Cowie is paymaster general United States Navy.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Sept. 30 for the following supplies under Proposal No. 679: (1) For 15,000 ft. of molding, type A; (2) 250 heat coils for Cook lightning arresters (composition); (3) 36 one-strip terminal boxes (new model); (4) 42 two-strip terminal boxes (new model); (5) 12-four strip terminal boxes; (6) 100 (1-lb.) cans of chromate for Fuller cells; (7) 50 30-amp fuses, type 3; (8) 1000 1-amp fuses, type 9; (9) 200 lb. insulating; (10) 50 binding posts for carbon plates for Fuller cells; (11) 10,000 paper sleeves (3/16 in. by 3 in.) ; (12) 18 hard-rubber battery syringes; (13) 1500 lb. bluestone in 50-lb. boxes; (14) 24 Eldridge battery voltmeters, 0-6 volt (Advance) in cases; (15) six syringe hydrometers, type V; (16) 50 spiral springs for telegraph keys; (17) 12 10-pair, S-8 Cook terminals; (18) 6000 12-in. oak insulator brackets; (19) 20 pay-out reels with shoulder carrying straps; (20) 700 19-point studs for model A connectors; (21) 250 self-soldering heat coils for Cook No. 8 protectors; (22) 150 cases for batteries; (23) 24 standard binding posts, flat base, wingnut, nickeled, type A; (24) 72 single binding posts, machine screw base, American style, nickeled, type C; (25) 50 frames for type V cells; (26) 12 Hubble porcelain, separable attachment plugs; (27) 400 Mason fused lightning arresters; (28) 100 pairs choke coils for Mason arresters, with carbon blocks and mica insulators; (29) one Western Electric No. 4a 60-pair protector strip, complete with carbons, mica and heat coils; (30) six 20-pair, S-8, fused, can-top Cook terminals; (31) six 50-pair, S-8, fused, can-top Cook terminals; (32) 24 corrugated, rod-type No. 17, electrose insulators; (33) two No. 306, AX, roof-type electrose insulators. Major W. L. Clarke is disbursing officer.

North Central

BAY CITY, MICH.—The Electric Light Department expects to purchase within the next four months two 75-lamp and two 100-lamp, 4-amp, constant-current transformers with direct-current reactance and 200 arc lamps. William H. Fitzhugh is superintendent of the municipal electric-light plant.

BLISSFIELD, MICH.—The electric-light committee expects to erect an addition to the municipal electric-light plant and to purchase a 150-kw or 200-kw engine-driven or turbine-driven generating unit within the next six months. R. H. Ellis is superintendent.

CRYSTAL FALLS, MICH.—The city of Crystal Falls has recently installed a new luminous-arc lamp (50 lamps) street-lighting system. J. H. Sanders is superintendent.

HOUGHTON, MICH.—The Houghton County El. Lt. Co., of Houghton, expects to erect within the next three months an addition to the substation building of the Houghton County Trac. Co. in Laurium. The company has purchased a new 13-panel switchboard for its substation and is making some changes in its high-tension lines. Gardner Rogers is manager.

PELLSTON, MICH.—The Cheyboygan El. Lt. & Pwr. Co., of Cheyboygan, has applied to the State Railroad Commission for permission to purchase the property of the Pellston Lt. & Pwr. Co.

SAULT STE. MARIE, MICH.—The Lake Superior Corpn. has awarded a contract for the deepening of its power canal from 18 ft. to 24 ft. to the Soo Dredging & Const. Co. for $300,000. This work is preliminary to a general extension of its steel mill on the Canadian Soo, the cost of which will aggregate $15,000,000.

TRAVERSE CITY, MICH.—The contract for construction of the dam for the Boardman River Lt. & Pwr. Co., of Traverse City, has been awarded to C. H. Smith, of Eaton Rapids.

BELLEFONTAINE, OHIO.—The City Council has decided to recommend a bond issue for improvements to the municipal electric light plant.

LANCASTER, OHIO.—The proposition to construct a municipal electric-light plant in Lancaster will be submitted to the voters at the November election.

McCOMB, OHIO.—The Board of Public Affairs expects to purchase within the next month one 150-hp tubular boiler, 140 lb. pressure, for the municipal electric-light plant. A. Keel is clerk of board of public affairs.

OAK HARBOR, OHIO.—At an election held Sept. 16 the proposition to issue $20,000 in bonds for the installation of a municipal electric light plant was carried.

WELLINGTON, OHIO.—The municipal electric light commission expects to purchase within the next six months a gas engine with a rating of about 100 hp to carry the day load. A. R. Branson is clerk.

CATLETTSBURG, KY.—The local electric light plant recently purchased by the Ohio Valley El. Ry. Co., of Huntington, W. Va., will be discontinued, and energy for operating the local system will be supplied from the power house of the Ohio Valley company at Kenova, 2 miles distant. A three-phase, 60-cycle, 2200-volt system will be used and 75 4-amp magnetite arc lamps will be installed in Catlettsburg, operated by 250 arc rectifiers in the Kenova plant. The name of the local company has not yet been decided upon. W. W. Magoon, of Huntington, W. Va., is general manager.

FULTON, KY.—Work has begun on remodeling the plant of the Fulton El. Lt. & Pwr. Co. The output of the plant will be increased by the installation of a 250-hp battery of boilers, replacing the present 100-hp boiler.

LAKELAND, KY.—We are informed that the power house was damaged by the fire recently, but little injury was done to the equipment of the power plant of the Central State Hospital at Lakeland, which in the issue of Sept. 13 was reported to have been destroyed. W. C. Gardner is superintendent.

LOUISVILLE, KY.—The new addition being erected to the plant of William Schuff & Co., of Louisville, will be equipped with electrically operated cutting machinery. The company may generate its own energy, although this has not yet been determined upon.

LOUISVILLE, KY.—The American Oak Leather Co. is equipping the cutting room of its Louisville plant with electrically operated cutting machinery. Other machinery will also be equipped for electrical operation. Preparations are being made by the company to install a generator to furnish energy to operate the plant.

PERRYVILLE, KY.—W. J. Debaun, owner of the local electric-light and ice plant, is contemplating increasing the output of both plants. Equipment for the plants, it is understood, will be purchased at once.

PIKEVILLE, KY.—The Sandy Valley Lt. & Pwr. Co., successor to the Pike Lt. & Pwr. Co., of Pikeville, has contracted with the Consol. Coal Co. for energy to be transmitted from Jenkins, Ky., at 40,000 volts. The company will close down its present plant (220-volt, direct-current) and use alternating current, 2200-110-volt, 60-cycle, and will establish a 24-hour service. L. L. Stone is manager.

ARGOS, IND.—The City Council has entered into a contract with the Rochester Lt., Ht. & Fuel Co., of Rochester, for energy to operate the municipal electric-light plant for a period of 20 years, beginning Oct. 1, 1913. E. E. Willsey is town clerk.

CENTERVILLE, IND.—The Public Utility Commission has approved an issue of $6,000 in bonds authorized by the town of Centerville for the installation of a municipal electric light plant. Bids have already been asked for construction of the plant.

PAXTON, ILL.—The Central Illinois Utilities Co., of Paxton, is erecting a power station, the initial equipment to consist of a 500-kw generating unit, Stirling boilers, etc.; also a 600-kva outdoor transformer station at Watseka.

CORNELL, WIS.—The City Council is considering the question of installing a municipal lighting system and water-works.

EAU CLAIRE, WIS.—Bids will be received by J. C. Fennesey, city clerk, until Sept. 30 for lighting the streets of the city by electricity.

GRANTSBURG, WIS.—Bonds to the amount of $9,000 have been voted for extensions to electric-light plant and water-works system.

RACINE, WIS.—The Milwaukee El. Ry. & Lt. Co. is planning to place its wires in the business district underground.

BIRD ISLAND, MINN.—The Village Board has awarded the Minnesota Central Lt. & Pwr. Co., of Glencoe, a contract for street lighting. The Council has passed a resolution authorizing cluster lamps on three blocks on Seventh Avenue. The company is erecting a new plant here and also proposes to supply energy for lamps and motors in Hector and Buffalo Lake.

MADISON LAKE, MINN.—A committee has been appointed by the Commercial Club to investigate the advisability of installing a municipal electric-light plant in connection with the water-works system. F. B. Knoff, Lewis Fitcher and C. E. Bush are members of the committee.

MORA, MINN.—Preparations are being made by the Mora El. Co. to enlarge its plant in order to establish a 24-hour service. The company was recently granted a 20-year franchise.

OLIVIA, MINN.—The Village Council expects to erect within the next two months a transmission line to transmit alternating current at 2300 volts; also to purchase within the next three months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc., in connection with the municipal electric-light plant. M. J. Dowling is president of the Village Council.

SPRING VALLEY, MINN.—Arrangements are being made by the Spring Valley El. Lt. & Investment Co. to rebuild its entire plant, changing the system from direct current to alternating current. New generators and boilers will replace those now in use, new wires will be erected and the wires on Broadway will be removed and placed in alleys. A transmission line will be erected to Grand Meadow to furnish electrical service in that village. Steps have been taken by the business men in Dexter to have a transmission line extended to that village.

BATTLE CREEK, IA.—The proposition to install an electric-lighting system in Battle Creek will soon be submitted to the voters.

DES MOINES, IA.—The Des Moines El. Co., it is reported, is planning to build a large power plant on the Des Moines River in this city to furnish electricity to surrounding cities and towns. The electric light and power plants at Colfax and Prairie City, it is said, will be taken over by the company, which already owns the systems at Oskaloosa, New Sharon and Montezuma. W. H. Thompson, Jr., is general manager of the company.

GARNER, IA.—The Enterprise El. Lt., Ht. & Pwr. Co. expects to purchase within the next six months one 100-hp engine and generator; also heating and cooking apparatus, vacuum cleaners, washing machines, etc. H. F. Kellogg is superintendent.

JEFFERSON CITY, MO.—The City Council is reported to have engaged an engineer to prepare plans and estimates for the installation of a municipal electric light plant.

LINN CREEK, MO.—Contracts have been awarded by the Niangua Heights Devel. Co., of Linn Creek, for the construction of dam and power house for hydroelectric power plant at the mouth of Linn Creek. The plans provide for the development of 300 hp at a cost of about $5,000. It is understood that the equipment has not yet been purchased. R. G. Scott & Sons are engineers.

MEXICO, MO.—The Mexico Pwr. Co. has agreed to erect four iron lamp standards, equipped with various styles of lamps, to enable the Council to decide upon the style of lamps for the new street-lighting system. E. R. Locke is manager.

MONTGOMERY CITY, MO.—The Montgomery Ice & El. Co. expects to remodel its ice plant during October and November and to increase the output from 5 tons to 10 tons per day; also to purchase water heater for a 100-hp boiler and skimmer for same. E. H. Algermissen is proprietor.

MOUND CITY, MO.—The Mound City El. Lt. & Ice Co. expects to erect within the next few months 10 miles of 6600-volt transmission line and two steel towers crossing the Missouri River. R. W. Neill is superintendent.

PLATTE CITY, MO.—The Platte City El. Lt. & Pwr. Co. expects to purchase within the next six months one 50-hp to 60-hp Corliss engine, and within the next two months a water pump; also within the next 30 days some incandescent lamps and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Smith Clemings is manager.

TIOGA, N. D.—Local business men have organized a stock company for the purpose of building an electric-light plant in Tioga. Work, it is understood, has already begun on the proposed plant.

RAPID CITY, S. D.—Bids will be received by J. S. Woodward, secretary board of education, until Oct. 11 for the installation of electric wiring, telephone system and program clock system in the high school building.

SPRINGFIELD, S. D.—A petition, it is reported, will be presented to the City Council in the near future asking that an election be called to submit the proposition to issue $15,000 in bonds for the installation of a municipal electric-light and power plant to the voters.

RAVENNA, NEB.—The Ravenna El. Lt., Ht. & Pwr. Co. expects to purchase within the next six months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. A. T. Shellarbarge is superintendent.

SALEM, NEB.—At an election held Sept. 15 the proposition to construct an electric-light plant was carried. R. B. Huston is village clerk.

Southern States

CHERRYVILLE, N. C.—Bids will be received by the Mayor and Board of Commissioners, Cherryville, until Sept. 30, for furnishing material for constructing complete water-works system, consisting of laying 5 miles of pipe, erection of pumping station, reservoir, steel tank and tower, deep wells, electric-driven pumping machinery, air compressors, etc. Plans and specifications may be obtained on application to J. Newton Johnston, engineer, Box 165, McColl, S. C. Plans are on file and may be seen at the office of J. B. Houser, Mayor.

SCOTLAND NECK, N. C.—Extensive additions are contemplated to the municipal electric-light plant, but as yet details have not been decided upon. L. R. Mills, Jr., is superintendent.

WILSON, N. C.—The city of Wilson expects to erect within the next twelve months a new power plant and to purchase two 500-hp turbines or engines, generators, boilers, exciters, pumps, condensers, oiling system, switchboard and 2½ miles of 0000 cable. R. J. Grantham is superintendent of water and lights.

CHARLOTTE, S. C.—The Southern Pwr. Co., of Charlotte, is reported to be contemplating the construction of another large power plant at Fishing Creek, on Broad River, about 15 miles from Rock Hill.

LANCASTER, S. C.—The Lancaster Lt. & Pwr. Co. expects to purchase within the next two months a few transformers and poles. J. T. Woodward is manager.

ATLANTA, GA.—The City Council has appointed a committee of five to look into the matter of the advisability of establishing a municipal electric-light plant and cost of same and report to the Council not later than the first Monday in December.

AUGUSTA, GA.—Contracts to build an electric railway between Augusta, Ga., and Columbia, S. C., have been awarded by the Carolina & Georgia Ry. Co. to M. P. McGrath, of New York, N. Y. The proposed railway will be 110 miles in length and will connect with the traction system in the Piedmont district built by James B. Duke.

GAINESVILLE, FLA.—Bids are being asked for the installation of an ornamental street-lighting system in the business district. The plans provide for 88 standards carrying five-lamp clusters (one 100-watt and four 60-watt tungsten lamps). The lamps will be maintained by underground wires (steel taped cable is to be used). G. H. Cairns is city engineer.

HOMESTEAD, FLA.—Application has been made to the City Council by F. J. Powers for a franchise to construct an electric-light plant and ice factory.

LARGO, FLA.—The installation of an electric-light plant is under consideration. J. N. McClung is reported to be interested in the project.

PENSACOLA, FLA.—The Pensacola El. Co. expects to complete within the next two months the construction of an addition to its power station and have in operation a 600-hp boiler, an 1875-kva Allis-Chalmers turbo-generator, a 500-kw-motor-generator set, a 50-kw Terry turbine exciter, a Westinghouse Le Blanc condenser and necessary switchboard panels for the above apparatus, (all additional equipment). Stone & Webster Engineering Corp., Boston, Mass., is engineer. Alba H. Warren is manager.

JACKSON, TENN.—The Jackson Ry. & Lt. Co. has applied to the City Council for a new franchise. If granted, it is understood that the company will make extensions and improvements to its property. S. S. Bush, Columbia Building, Louisville, Ky., is manager.

RIPLEY, TENN.—The Ripley Lt., Wtr. & Ice Co. expects to purchase within the next six months one three-phase generator and a series street-lighting system. W. A. McCallum is superintendent.

ROANOKE, ALA.—The Council is considering the question of issuing $20,000 in bonds for the municipal electric light and water plant. W. Y. Chewning is Mayor.

OKOLONA, MISS.—The managers of the municipal electric-light and water plant expect to purchase a deep-well pump within the next four months. T. M. Beaty is manager.

MARKSVILLE, LA.—The Town Council has awarded the contract for the construction of an electric-light plant and water-works system to C. A. Reese, of Shreveport.

BLACKWELL, OKLA.—Improvements are being made to the municipal

electric-light plant, including the installation of a 300-hp water-tube boiler. R. C. Morris is electrician.

GRANDFIELD, OKLA.—The Town Council has granted an electric-lighting franchise to Messrs. Brabham and Edwards, of Frederick.

BEEVILLE, TEX.—The Beeville Pwr. & Lt. Co., recently organized, it is understood, will take over the properties of the Beeville Ice & Pwr. Co., the Beeville Mfg. Co. and the Beeville Wtr. Co. and will supply water, electricity for lamps, heat and motors, ice and cold-storage service in Beeville, and probably in other places in this vicinity. J. W. Greer is general manager.

DUBLIN, TEX.—The Dublin Gas & El. Co. is planning to erect a transmission line from Dublin to Hamilton. It is now erecting a transmission line from Dublin to Hico, a distance of 22 miles. The company also proposes to build a new central power station to furnish energy for the three systems, to be located in one of the three towns, the location to be decided upon later.

EAGLE PASS, TEX.—The International El. Co., of Eagle Pass, has entered into a contract with the Rio Grande Valley Land Co. and the Indio Cattle Co. to supply energy for operating a number of irrigation pumping plants upon lands which the two companies are developing. The International El. Co. will erect a system of distribution lines to points in this section and to the ranches of the two companies with which it has made contracts. The company will also enlarge its power station in Eagle Pass at a cost of about $55,000.

GALVESTON, TEX.—A special meeting of the stockholders of the Galveston-Houston El. Co. has been called for Oct. 6 to vote on the proposition of increasing the capital stock by $2,000,000 to provide funds for extensions and improvements to the street railway service in Galveston and Houston, as well as the interurban line between the two cities. Among the proposed improvements is included an increase of power facilities, purchase of new equipment, construction of carhouses and extensions of track.

GATESVILLE, TEX.—The Gatesville El. Lt. & Pwr. Co. expects to erect within the next six months a power house and to purchase a generator, a 200-hp Diesel engine (gas) and a gas producer. C. F. Caruth is secretary.

HEREFORD, TEX.—The Hereford El. Lt. & Pwr. Co. expects to install a 10-ton ice plant within the next six months; also to purchase one 125-hp return tubular boiler. F. H. Oberthier is owner and manager.

PALESTINE, TEX.—Work will soon begin on construction of plant of the Texas Lt. & Pwr. Co., to replace the one recently destroyed by fire.

SEQUIN, TEX.—The Hamilton Townsite Co., which proposes to develop 225 acres for townsite and 10,000 acres for farming at junction of Nueces, Frio and Atascosa Rivers, contemplates the installation of an electric-light plant, water-works, ice factory, hotel, etc. Bids for artesian wells, dams, hotel and ice plants are now being received. Charles R. Tips is general manager.

Pacific States

ELMA, WASH.—The Elma Lt. & Pwr. Co. has applied to the County Commissioners for a franchise to erect transmission lines along the county road between Montesano and Satsop, and also from Elma south to the Chehalis River.

PE ELL, WASH.—The Central Pwr. Co., of Pe Ell, has applied to the Commissioners of Pe Ell County for a franchise to extend its transmission lines to Frances and Lebam.

NEWBERG, ORE.—The Yamhill El. Co. is erecting a 4-mile transmission line for rural service to furnish electricity to farmers and fruit driers. The company has completed a transmission line (4 miles long) and a distributing system in St. Paul, Ore. C. J. Edwards is manager.

SHERIDAN, ORE.—Preparations are being made by the Sheridan Lt. & Pwr. Co. for the installation of two feeder panels, one synchroscope, etc., the erection of a transmission line connecting Willamina and Sheridan, 5 miles long, connecting the plants in the two towns, and reconstructing lines in Sheridan, work on which will begin Oct. 1. The company has recently installed a new boiler and six transformers. O. L. Davis, foreman, will have charge of the work. J. L. Thompson is general manager.

RANDSBURG, CAL.—The Yellow Aster Mining & Milling Co. has entered into a long-term contract with the Southern Sierras Pwr. Co., of San Bernardino, whereby the latter agrees to furnish energy to operate the machinery in the Yellow Aster mine and mills and various pumping plants. It is estimated that about 1200 hp will be required.

PRESCOTT, ARIZ.—A syndicate of Bangor (Maine) men, represented by J. Barton Nealey, has secured an option on the holdings of the Cataract Canyon Pwr. Co. If taken over, the purchasers propose to construct a large hydroelectric power plant in Cataract Canyon. The water has a drop of 1800 ft. in a distance of 6 miles. The proposed plant will have an output of 12,000 hp, which will be transmitted to a number of mining camps and towns in this part of Arizona.

CARTERSVILLE, MONT.—Plans are being prepared by the Cartersville Land & Irrig. Co., of Minneapolis, Minn., for the construction of two irrigating projects to irrigate 15,000 acres of land. Three pumping stations will be erected, requiring a total of 3000 hp, to be developed from coal mines owned by the company. Steam and gas producer units are being considered. Bids for construction of the work will be received about April 1. J. H. Cunningham, Lumberman Building, Portland, Ore., is chief engineer.

RED LODGE, MONT.—Members of the Commercial Club of Red Lodge have organized a company under the name of the Red Lodge El. Ry. Co. to build an electric railway to Bear Creek, a distance of 9 miles. It is understood that work will begin on the proposed railway this fall.

DOUGLAS, WYO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 29 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Douglas, Wyo. Drawings and specifications may be obtained from the custodian of the site at Douglas, Wyo., or from the above office. O. Wenderoth is supervising architect.

BEOWAWE, NEV.—Plans are being considered for the installation of an electric-light system in Beowawe, energy to be supplied from the proposed new plant to be located in the Humboldt Mountains. George Wingfield is reported to be interested in the project.

BUCKHORN, NEV.—The installation of an electric-light system in Buckhorn is under consideration. Energy for operating the system is to be secured from the proposed new plant to be located in the Humboldt Mountains. George Wingfield is reported to be interested in the enterprise.

Canada

VANCOUVER, B. C.—The British Columbia El. Ry. Co. has submitted a proposition for furnishing electricity to light the municipality of Saanich. The company offers to furnish energy at 3½ cents per kw-hr. if a minimum of 500 80-watt lamps are used, or at 3 cents per kw-hr. if 1000 lamps are used.

VANCOUVER, B. C.—We are informed that the city of Vancouver does not contemplate the construction of a hydroelectric plant as reported in the issue of Sept. 6. The city will not be in a position to consider the question of municipal ownership of a lighting plant until the expiration of the franchise of the British Columbia El. Ry. Co.

PORTAGE LA PRAIRIE, MAN.—Plans are being considered for the erection of a transmission line from Winnipeg to Portage la Prairie to supply energy for lamps and motors. The cost of the line is estimated at $250,000. D. Deacon is Mayor.

SOURIS, MAN.—A by-law was passed on Sept. 2 authorizing the expenditure of $40,000 for the installation of an electric-light and power plant.

TRURO, N. S.—The Town Council, it is reported, has decided to install a municipal electric-light plant. Generating machinery with necessary auxiliary equipment and also a complete outfit for ornamental street-lighting system will be required.

BRAMPTON, ONT.—The Council has passed a by-law authorizing an issue of $15,000 in debenture bonds to provide funds for an extension to the Hydro-Electric Power Commission system.

FOREST, ONT.—The town of Forest has recently purchased the local electric-light plant (by expropriation) and is now building a new power station near the town hall. The generating equipment (a 70-kva Westinghouse unit) in the present plant will be transferred to the new building. Extensions will be made to the distribution system and concrete poles erected. The streets will be illuminated by 100-watt tungsten lamps. H. A. McLean, town engineer of Sarnia, is supervising the work.

GALT, ONT.—The illumination of Jackson Park with cluster-lamps erected on ornamental standards is under consideration by the City Council.

KINGSTON, ONT.—Tenders have been called for furnishing and installing approximately 20,000 ft. of underground conduit. C. C. Folger is general manager of the Light, Heat and Power Department.

LINDSAY, ONT.—A by-law was passed on Sept. 3 authorizing a contract with the Lt., Ht. & Pwr. Co. of Lindsay to light the streets of the city. The contract provides for magnetite-arc lamps, erected on ornamental standards on Main Street, to be maintained by underground wires.

OWEN SOUND, ONT.—The Hydro-Electric Power Commission has submitted estimates to the town of Owen Sound showing that Eugenia Falls on the Beaver River will develop 1400 hp. without the use of a storage basin and 4000 hp with a storage basin. The commission last spring offered to furnish energy in Owen Sound to the amount of 1500 hp at $29 per hp per year or 800 hp at $31 per hp per year. The town decided upon the latter quantity provided it could be shown that the river at the dry season would develop that amount. The length of the transmission line will be under 30 miles.

WESTBORO, ONT.—The Ottawa El. Co. has been awarded the contract for lighting the streets of the village with 50 100-watt tungsten lamps, at $13 each per year, for a period of 10 years.

GRANBY, QUE.—A syndicate in which McQuaig Brothers are interested is reported to have purchased power sites on St. Francis River near Drummondville, where it is estimated that 8000 hp can be developed. It is proposed to transmit energy developed at the plant to Granby provided an agreement can be made with the municipality.

PRINCE ALBERT, SASK.—The City Council is considering the question of building a new steam-driven power plant, including power house, to cost about $275,000. O. Davidson is clerk.

REGINA, SASK.—The City Council is considering an extension to the ornamental street-lighting system in Regina.

WOLSELEY, SASK.—On Aug. 27 a by-law was passed authorizing the purchase by the town of the Central Lt. & Pwr. Co. The town will take over the plant as soon as possible and it will make the improvements that have been recommended by the engineer in charge, which include the installation of a 30-kw generator immediately and a 150-hp producer gas equipment next year.

Mexico

MAZATLAN, SINALOA, MEXICO.—The Empresa de Corriente Electrica, S. A., of Mazatlan, expects to install within the next four months a 165-hp suction gas-producer plant, a 120-kw, two-phase, 60-cycle, 1100-volt Westinghouse alternator to be driven by gas engine, switchboard and instruments for above unit. The above equipment has already been purchased. If results are favorable, the entire plant will be changed over. Arthur de Cima is general manager.

TAMPICO, MEX.—The Standard Oil Co. is preparing the site and doing other preliminary work toward the erection of a large oil refinery at a point on the Panuco River about 6 miles below Tampico. The company will erect an electric light and power plant, a water-works system and lay out a model town for its employees. It is said that the project will involve an expenditure of more than $2,000,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 8 for furnishing oil-burning forges and furnaces and thermoelectric pyrometer. Blanks and general information relating to this circular (No. 800) may be obtained from the above office or at the offices of the assisting purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

MARSEILLES, ILL.—The Consumers' Wtr. & Lt. Co. has been incorporated with a capital stock of $50,000 by W. H. Carnahan, H. J. Vance and C. D. Johnson.

FORT BRANCH, IND.—The El. Lt. Co. of Fort Branch has been incorporated by Walter C. Polk, Homer T. Genung and William A. Polk. The company is capitalized at $20,000 and proposes to furnish electricity for lamps and motors.

NEW RICHMOND, IND.—The Montgomery Lt. & Pwr. Co. has been chartered with a capital stock of $24,000 to construct and operate an electric plant. The directors are: O. W. Mason, Charles Haywood, R. N. Carding, H. C. Shobe, A. S. Fraley and J. C. Wingate.

NORRIDGEWOCK, MAINE.—The Bombazee Pwr. Co. has been incorporated with a capital stock of $50,000 for the purpose of buying and developing water rights along the Kennebec River. The directors of the company are: Charles H. Hussey, president; Eben S. Miller, treasurer; G. C. Wing, William Ayer, William Brackett and Frank W. Spaulding.

KEARNEY, MO.—The Kearney El. Lt. Co. has been incorporated with a capital stock of $5,000 by Thomas H. Henderson, Lee Major and John A. E. Eby.

LINDSAY, MONT.—The Mutual Tel. Co. has been organized with a capital stock of $20,000 by W. C. Fellows, P. J. Noe, C. E. Rainey, L. D. Richards and others.

WATERVILLE, N. Y.—The Tri-County El. Co. has been incorporated by E. G. Morris, George P. Conkling and Thomas F. Barrett, of Utica.

VALLEY FORGE, PA.—Application will be made to the Governor of the State of Pennsylvania on Oct. 6 for a charter for the Valley Forge El. Lt. & Pwr. Co. by Thomas E. O'Connell, V. N. Shaffer, I. E. Miller, H. D. White and M. F. Hackett. The company proposes to generate and distribute electricity in Valley Forge.

BEEVILLE, TEX.—The Beeville Pwr. & Lt. Co. has been incorporated with a capital stock of $150,000 by T. W. Robertson, A. H. Murris and C. M. Chambers.

BOERNE, TEX.—The Boerne Lt. & Ice Co. has been incorporated with a capital stock of $15,000 by George H. Cushman, E. J. Altgelt and Henry C. King, Jr., all of San Antonio.

LOGAN, W. VA.—The Logan Ltg. Co. has been granted a charter with a capital stock of $200,000. The incorporators are Henry C. Finkel, 106 G Street, N. W.; Gillbank Twigg and others, all of Washington, D. C.

Weekly Record of Electrical Patents

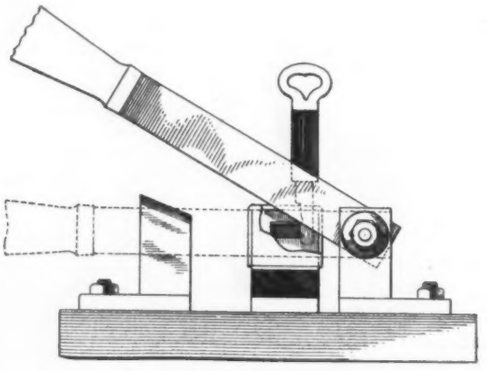
UNITED STATES PATENTS ISSUED SEPT. 16, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,073,098. ELECTRICAL MEASURING INSTRUMENT; C. M. Crook, Chicago, Ill. App. filed Nov. 27, 1908. Wattmeter constructed to maintain a constant adjustment of parts.

1,073,113. INCANDESCENT-LAMP LOCK; J. H. A. Gardiner, Downers Grove, Ill. App. filed July 11, 1912. Split-ring, screw-actuated clamp; secures lamp in the socket.

1,073,130. SIGNAL SYSTEM; A. N. Hovland, Stakke, Norway. App. filed Jan. 27, 1909. For effecting control of apparatus at a distant point.



1,073,289.—Electric Switch.

1,073,173. RHEOSTAT; D. P. Ruger, Chicago, Ill. App. filed July 22, 1910. The contact member has a rolling engagement over the contact pieces of the resistance element.

1,073,175. FLUID-PRESSURE SWITCH; J. A. Schadel, Pittsburgh, Pa. App. filed Feb. 14, 1911. Governor for compressed-air systems.

1,073,192. ELECTRIC SIGNALING DEVICE; W. J Warder, Jr., Chicago, Ill. App. filed Nov. 6, 1911. When the lamp of the signal device burns out or becomes inoperative a new lamp is automatically shifted into its place.

1,073,200. CONTROLLING SYSTEM FOR ALTERNATING-CURRENT MACHINES; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed March 7, 1903. The number of transformer turns connected to the motor circuit is enlarged to increase the speed and dimirished to reduce the speed.

1,073,201. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Commutator-type alternating-current machine with magnetizing winding on the rotor, and brushes of the secondary winding short-circuited.

1,073,263. ELECTRIC VULCANIZER; F. Martin, Pomona, Cal. App. filed July 25, 1912. Has thermostatic control to maintain a proper heat.

1,073,281. SERVICE-SWITCH MECHANISM; G. E. Palmer, Brookline, Mass. App. filed Dec. 16, 1912. Customer is able to open the switch for inspecting or replacing the fuse, but the live lugs or contacts are sealed so as to be inaccessible to the customer.

1,073,289. ELECTRIC SWITCH; F. J. Robinson, Lackawanna, N. Y. App. filed June 17, 1912. A key-opened lock prevents unwarranted closing movement of the switch blade.

1,073,295. COMBINATION LOCK FOR PLUG-AND-SOCKET FIXTURES; G. I. Silbert, Chicago, Ill. App. filed Feb. 20, 1911. Combination tumbler lock in which the need for a dial and co-operating indicator is done away with.

1,073,303. TROLLEY GUARD; M. Szwargulski, St. Louis, Mo. App. filed Jan. 27, 1913. Weight-actuated pivoted guard fingers prevent disengagement of the trolley and serve as bridging contacts at crossovers and switches.

1,073,311. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Alternating-current machine of commutator type in which the exciting winding is in series with the rotor-working winding so that the current is in phase with the working current.

1,073,320. RESISTANCE UNIT; W. L. Bliss, Niagara Falls, N. Y. App. filed Jan. 6, 1911. Resistance unit provided with terminals adapted to engage terminal clips detachably.

1,073,335. SIGNALING SYSTEM; H. W. Doughty, Binghamton, N. Y. App. filed April 9, 1912. Fire-alarm system in which the tower service may be disconnected at the central station.

1,073,336. ELECTRICALLY HEATED CURLING IRON; F. A. English, Chicago, Ill. App. filed April 14, 1913. Terminals on the handle capable of rotative adjustment permit turning of the iron to curl the hair.

1,073,397. CONTROLLER; C. E. Cochran, Cleveland, Ohio. App. filed July 22, 1912. The controller is operable only when the motorman is at his station.

1,073,510. SAFETY AND SIGNALING DEVICE FOR RAILROADS; D. C. Newton, Owego, N. Y. App. filed Feb. 20, 1913. Contact shoes on the engine engage contact rails on the track-bed.

1,073,582. ALARM SYSTEM; O. B. Kaiser, Ramona, Ohio. App. filed Oct. 17, 1910. For the supervision of automatic sprinkler systems.